Journal of the Royal Sanitary Institute

Royal Sanitary Institute


THE ROYAL SANITARY INSTITUTE, FOUNDED 1876.
SALUS GENERIS HUMANI.

1906.

Shelved chronologically with Journal of the Sanitary Institute of Great Britain.

JOURNAL

OF

THE ROYAL SANITARY INSTITUTE.

TRANSACTIONS, VOL. XXVII.

1906.

LONDON:

OFFICES OF THE ROYAL SANITARY INSTITUTE, MARGARET STREET, W.

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1907.

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Volume XXVII. No. 1. Issued February, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

SOME OBSERVATIONS UPON THE PRACTICAL STANDARDISATION OF DISINFECTANTS.

By HENRY KENWOOD, M.B., D.P.H.,
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OF late years the necessity of more practical methods for testing the absolute and relative values of various disinfectants has been increasingly recognised. Rideal and Walker have proposed that the destruction of a particular germ in pure culture should be the criterion of a disinfectant, phenol being taken as the standard, and *B. typhosus* being suggested as the standard germ in these determinations. A "Carbolic Acid" co-efficient can thus be deduced, which, there is a tendency to imply, will be found a sufficient and reliable guide for the dilution of the particular disinfectant in actual practice. But the method often has a value attached to it far beyond what its advocates have ever claimed, or would ever recognise. It appears, for instance, to be the view of the less initiated, that because a disinfectant "X" has a higher carbolic acid co-efficient than another disinfectant "Y," when tested upon *B. typhosus* under artificial conditions, that "X" is the more powerful disinfectant under all circumstances and conditions. This is not necessarily the case; and, moreover, while the *B. typhosus* in fæces is difficult to destroy, the bacillus in a trace of artificial media is so little resistant to disinfectants that it is dangerous to take such experiments as indicating the strength at which a disinfectant should be employed in common general practice to kill the germ embedded in large quantities of fæces, or suspended in a large volume of urine. While recognising, therefore, that the method of

standardisation proposed by Rideal and Walker is a valuable suggestion in the direction of providing that uniformity of laboratory procedure which is desirable amongst workers, it does not supply us with a useful indication of the strength at which a disinfectant must be employed in actual practice, because it does not take into account the influence of the associated organic matter upon the potentialities of the disinfectant. As Klein has well said, "the nurse who is supposed to disinfect a typhoid stool is not acting on a watery or saline emulsion of a culture of the typhoid bacillus, but on material of a highly complex composition, and altogether of a different nature from the laboratory culture."

We have recently made a series of experiments with typhoid stools and typhoid urine with the view of determining the absolute and relative value of a few disinfectants under the conditions that obtain in practice, in order to see to what extent the carbolic acid co-efficient may vary according as to whether or not the estimation is placed upon a practical basis. It was our aim, therefore, to reproduce as closely as possible in these experiments the conditions of employment of disinfectants in actual practice, and to test the resistance of the organism in its natural environment. The results have not the mathematical sequence of pure culture experiments, but they appear to us to indicate the only lines upon which a method of standardisation for *practical purposes* should be conducted.

Now, the disinfectant to be employed for practical purposes should not be one which exhausts itself in an indiscriminate attack upon organic matter, living or dead; nor should it give off an odour which is generally found to be repugnant to the patient and to those in attendance. From these considerations we excluded certain disinfectants from our experiments, but we have included carbolic acid in order that we might show the powers of the others as compared with a disinfectant which is now so often employed for standardising purposes. Phenyle was included as it is typical of a whole series of coal-tar derivatives.

The excellent results hitherto obtained by many workers in testing the bactericidal powers of izal and cyllin (two agents which are not disagreeable in use and which are comparatively non-poisonous) determined us in the selection of these two preparations for our experiments. We find no appreciable difference between them as to the permanence and non-volatility of the active constituent in each case.

Preparations containing phenol (with which phenyle will be classed) are markedly poisonous, although far less so than corrosive sublimate, and there is much recorded testimony of the dangers of their employment by the general public. Agents which, like izal and cyllin, are compara-

tively non-poisonous, are certainly to be preferred. The odour of carbolic preparations is perhaps a feature which may be claimed as an advantage, for apart from the circumstance that the general public has a deep-rooted conviction that the efficiency of a disinfectant is proportionate to its odour, and therefore has little confidence in an odourless preparation, there is an undoubted advantage in the employment of a disinfectant for the sick-room which is capable of disguising other odours and of advertising the existence of infectious illness in the dwelling. The odour of phenol is, however, repellant to many, and the complaint is not infrequently made that it occasions headache or even nausea. In this respect both izal and cyllin present advantages, for their odour is not unpleasant. We have never known of a complaint on this account after an extensive employment of izal in sick-rooms occupied for long periods by consumptives, and the odour of cyllin is not more marked or objectionable.

An objection is raised by some to the use for public purposes of proprietary or patented disinfectants, such as izal and cyllin. But while some prejudice is justified against accepting everything that is claimed for such disinfectants, particularly when such statements emanate from proprietors or patentees, it is difficult to understand the reason for this prejudice when independent and responsible workers have demonstrated that such an agent best meets practical requirements. If all proprietary articles were to be tabooed in public work, few of those agents, apparatus, or appliances which meet with most favour at the present day would remain to us, and doubtless the loss to preventive medicine would be very great.

It was hoped that it might have been possible to detect the typhoid bacillus in the fæces and urine used in the experiments; but, failing this, it was decided that the *Bacillus coli* should be made the basis of the tests. There is a general concensus of opinion that the *B. coli* is a hardier organism, *i.e.*, is less easily destroyed, than the typhoid bacillus; and it may therefore be assumed that where the *B. coli* has been destroyed the *B. typhosus* has also certainly been destroyed.

The culture media employed for both the control cultures (cultures from the fæces and urine *before* treatment with the disinfectants) and for the test cultures (cultures from the fæces and urine *after* treatment with the disinfectants) were (*a*) bile-salt glucose peptone water (McConkey) contained in Durham's tubes (about 10 cc. of the medium in each tube), and (*b*) Conradi-Drigalski nutrose agar plates. After several of the experiments had been performed it was found that the Conradi plates gave no useful indications, and they were therefore not used for the test cultures in the later experiments, the bile-salt tubes only being employed.

The typhoid bacillus was never isolated. On several occasions colonies resembling those of the typhoid bacillus were obtained in the control cultures on Conradi plates, but these on more critical examination did not prove to be typhoid colonies. On one occasion an organism was isolated which closely corresponded with the typhoid bacillus in its morphological and cultural characters, but it failed to agglutinate with a good typhoid serum. Our experience is not exceptional. Thus Klein and Houston* investigated eleven cases of typhoid, making from three to five Conradi plates for each case, or a total of 42 Conradi plates. The typhoid bacillus was isolated from only two cases, one colony from one, and nine colonies from the other.

Again, Conradi states that after six years' experience of the method of isolation of the typhoid bacillus by the Conradi-Drigalski medium, he estimates that a bacteriologist requires six months' experience before his eye becomes properly trained to appreciate the minute distinctions appertaining to the colonies of the typhoid bacillus on this medium.† This shows the enormous difficulties of isolation by the Conradi-Drigalski agar; and yet this medium is the best we at present possess for the purpose.

We therefore had to fall back on the presence or absence of the *B. coli* in our cultures as a test of the efficiency of the disinfectants. For this purpose the bile-salt medium proved of more service than the Conradi plates, since much more of the material (fæces or urine) could be sown into the test cultures than is possible with the Conradi plates, without rendering the number of experiments unwieldy. It must be remembered that in each experiment we were dealing with at least sixteen mixtures, each of which had to be sub-cultured in the test cultures, and to have multiplied the test cultures materially would have given us more cultivations than we could possibly have dealt with.

The general procedure in the experiments was as follows:—The materials (fæces and urine) were obtained the first thing in the morning. The fæces and urine in each case, with one exception, were the mixed stools and the mixed urine of more than one case of undoubted typhoid, admitted into the typhoid wards of one of the Metropolitan Asylums Board hospitals. In the appendix some facts as to the patients who furnished the material for the experiments are set out, and it will be seen that no reasonable doubt can be entertained that the fæces contained typhoid germs.

The fæces were usually pultaceous (the so-called typical pea-soup stools of typhoid being now comparatively rare), and where necessary sufficient sterile tap-water was added to them and thoroughly mixed in, so

* Report of Medical Officer of Local Government Board for 1902-03, p. 622.

† Ann. de l'Inst. Pasteur, Sept., 1905, p. 583.

as to form a mixture of the consistence of pea-soup. The fæces mixture and urine were then divided between us, and the subsequent manipulations were carried out independently; but in all cases the same culture medium was used by both of us, so that any possible discrepancies due to slight variations in the composition, etc., of the culture medium were avoided. The disinfectant solutions employed were, moreover, made up from the same samples of the disinfectants, bought in the open market; this we consider an indispensible and important proviso. In some of the experiments equal volumes of the solutions made up by each of us were mixed, thus, as far as possible, avoiding any discrepancies which might arise from any faint difference in strength of the solutions. The solutions were all 5 per cent. ones, made up with ordinary tap-water (sterilised by boiling), and the same solutions were employed throughout.

In all cases the disinfectant solutions were exposed in open vessels at the temperature of the laboratory for five hours before being used. The object of this was to imitate the conditions which obtain in actual practice, where a solution after being made up may remain exposed for some time before use.

Amounts of 25 cc. of the fæces and of the urine, respectively, were placed in sterile Erlenmeyer flasks, and to these varying quantities of the disinfectant solutions were added and thoroughly mixed in. After the mixtures had stood for half-an-hour, sub-cultures were made in order to test for the survival of the *Bacillus coli.* The only variable factor, therefore, was the amount of disinfectant added, the amount of material treated and the time of exposure remaining constant for all the experiments, the results of which are tabulated in Tables 1–4.

In the case of the fæces, at the end of the half hour one large loopful of the mixture was sown from each flask into the glucose bile-salt peptone water tubes (Durham's) and in the case of the urine 0·2 cc. of the mixture was similarly added to the bile-salt tubes. The cultures were then incubated at 40°–42° C. and examined from day to day up to three days after incubation. Tubes showing acid, or acid and gas production, were further examined by hanging drops to determine the nature of the organisms which had developed, and many of the tubes in which bacilli were found were sub-cultured in addition, definitely to determine whether the *B. coli* was present or no. These sub-cultures were made first by diluting a loopful of the culture in 10 cc. of sterile water and then distributing a loopful of this dilution over the surface of a sloped gelatine tube. If characteristic colonies developed, sub-cultures were made in lactose peptone water and in litmus milk: the fermentation of glucose had previously been determined by the results given by the glucose bile-salt tubes.

The results obtained are detailed in the following tables:—

TABLE 1.—*Disinfectant, Izal, 5 per cent. solution.*

No. of Experiment.	Amount of Disinfectant in cc.'s.	Fæces.		Amount of Disinfectant in cc.'s.	Urine.	
		Hewlett.	Kenwood.		Hewlett.	Kenwood.
1	20	O	—	20	O	—
	12·5	—	A	12·5	—	O
	10	O	—	10	O	—
2	7·5	O	A	5	O	O
	5	O	A	2·5	O	O
3	4	A	A	2	O	A
	2	A+G. *C*	A+G	1	O	A
4	3	O	O	1	O	A+G
	2	A	A	0·5	A+G. *C*	A+G
5	2	A. *S*	A	1·5	O	O
	1·5	A. *B*	A	1	O	O
6	2	A. *S*	A. *S*	1	A. *B* not *C*	A. *B*
	1·5	A+G. *B C?*	A+G. *B*	0·5	A. *B* not *C*	A. *B*
7	2·5	A+G. *C*	A+G. *B*	1	O	O
	2	A+G. *C*	A+G. *B*	0·5	A+G. *C*	A+G. *B*
	1·5	A+G. *C*	A+G. *B*	—	—	—
8	3·5	O	O	1·5	O	O
	2·5	O	A. *S*	0·5	O	O
	1·5	A+G. *C*	A+G. *B*			

A = production of acid; G = production of gas: O = no change and no growth in the culture of medium; *Y* = presence of yeast cells; *S* = presence of streptococci; *B* = presence of bacilli microscopically; *C* indicates that the *B. coli* was identified by subcultures.

From these experiments it appears that *B. coli* may survive in 25 cc. of fæces when izal (5 per cent. strength) is added up to 2·5 cc.; and when in 25 cc. of urine, izal up to 0·5 and perhaps 1 cc. is added.

TABLE 2.—*Disinfectant, Cyllin, 5 per cent. solution.*

No. of Experiment.	Amount of Disinfectant in cc.'s.	Fæces.		Amount of Disinfectant in cc.'s.	Urine.	
		Hewlett.	Kenwood.		Hewlett.	Kenwood.
1	20	O	—	20	O	—
	12·5	—	A	12·5	—	O
	10	O	—	10	O	—
2	7	O	A	5	O	O
	5	O	A	2·5	O	O
3	4	A	A	2	O	A
	2	A+G. *C*	A+G	1	O	A
4	3	A	A	1	A+G. *C*	O
	2	A	O	0·5	O	A+G
5	2	A	O	1	A+G. *C*	O
	1·5	A	A	0·5	O	A+G
6	2·5	A. *Y & S*	A. *S*	1·5	O	O
	2	A+G. *C*	A+G. *B*	1	A	A
	1·5	A	A	0·5	A	A
7	2·5	A+G. *C*	A+G	1·5	O	O
	2	A+G. *C*	A+G	1	O	O
	1·5	A+G. *C*	A+G	0·5	A+G. *C*	O
8	3·5	O	O	1·5	O	O
	2·5	O	A	0·5	O	O
	1·5	A	A			

A = production of acid; G = production of gas; O = no change and no growth in the culture medium; *Y* = presence of yeast cells; *S* = presence of streptococci; *B* = presence of bacilli microscopically; *C* indicates that the *B. coli* was identified by subcultures.

From these experiments it appears that *B. coli* may survive in 25 cc. of fæces when cyllin (5 per cent. strength) is added up to 2·50 cc.; and when in 25 cc. of urine, cyllin up to 1·0 cc. is added.

TABLE 3.—*Disinfectant, Phenol,* 5 *per cent. solution.*

No. of Experiment.	Amount of Disinfectant in cc.'s.	Fæces.		Amount of Disinfectant in cc.'s.	Urine.	
		Hewlett.	Kenwood.		Hewlett.	Kenwood.
1	20	O	—	20	O	—
	12·5	—	A	12·5	—	O
	10	O	—	10	O	—
2	7·5	O	A	5	O	O
	5	O	A	2·5	A+G. Cocci	A
3	4	A+G. *C*	A+G. *B*	2	A+G. *C*	A+G. *B*
	2	A+G. *C*	A+G. *B*	1	A+G. *C*	A+G. *B*
4	5	A	A+G	3	A+G. ?	A+G
	4	A	A+G	2	A+G. *C*	A+G
5	4·5	A. *B*	A+G. *B*	4	O	O
	3·5	A. *B*	A+G. *B*	3	A+G. ?	A+G. *B*
6	5	A. *S*	A	3·5	A. *Y* and *S*	A
	4·5	A. *S*	A. *B?*	3	A. *B* not *C*	A. *B*
	4	O	A	2·5	A+G. *C*	A+G. *B*
7	4·5	A+G. *C*	A+G. *B*	3·5	A. *B* not *C*	A+G. *B*
	4	A. G	A+G. *B*	3	A+G. *C*	A+G. *B*
	3·5	A+G. *C*	A+G. *B*	2·5	A+G. *C*	A+G. *B*
8	6	A+G *C*	A	4	A. *S*	A+G. *B*
	5	A+G. *C*	A. *S*	3	A. *S*	A+G. *B*
	2	A+G. *C*	A+G. *B*	—		

A = production of acid; G = production of gas; O = no change and no growth in the culture medium; *Y* = presence of yeast cells; *S* = presence of streptococci; *B* = presence of bacilli microscopically; *C* indicates that the *B. coli* was identified by subcultures.

From these experiments it appears that *B. coli* may survive in 25 cc. of fæces when phenol (5 per cent. strength) is added up to 6 cc.; and when in 25 cc. of urine, phenol up to 4 cc. is added.

TABLE 4.—*Disinfectant, Phenyle,* 5 *per cent. solution.*

No. of Experiment.	Amount of Disinfectant in cc.'s.	Fæces.		Amount of Disinfectant in cc.'s.	Urine.	
		Hewlett.	Kenwood.		Hewlett.	Kenwood.
1	20	O	—	20	O	—
	12·5	—	A	12·5	—	—
	10	A	—	10	O	—
2	7·5	A	A	5	O	O
	5	A	A	2·5	O	O
3	4	A+G. *C*	A+G. *B*	2	A+G. *C*	A+G. *B*
	2	A+G. *C*	A+G. *B*	1	A+G. *C*	A+G. *B*
4	5	A+G. *C*	A+G	3	A	O
	4	O	A+G	2	A. *B* ? *C*	A *B*
5	5·5	A. *B*	A+G. *B*	2·5	O	O
	4·5	A. *B*	A+G. *B*	1·5	A	A+G. *B*
6	5·5	A. *S*	A. S.	2·5	A	A
	5	A+G. *C*	A+G. *B*	2	O	A
7	5·5	A+G. *C*	A+G. *B*	2·5	O	O
	5	A+G. *C*	A+G. *B*	2	O	O
	4·5	A+G. *C*	A+G. *B*	1·5	A+G. *C*	A. *B*
8	6·5	O	A. *S*	2·5	O	O
	5·5	A. *S*	A. *S*	1·5	O	O
	4·5	A. *S*	A+G. *B*			

A = production of acid: G = production of gas; O = no change and no growth in the culture medium; *Y* = presence of yeast cells; *S* = presence of streptococci; *B* = presence of bacilli microscopically; *C* indicates that the *B. coli* was identified by subcultures.

From these experiments it appears that *B. coli* may survive in 25 cc. of fæces when phenyle (5 per cent. strength) is added up to 5·5 cc.; and when in 25 cc. of urine, phenyle up to 2 cc. is added.

On the whole it will be seen from the above tables that there is a fair correspondence in the results obtained by both of us. There are, it is noteworthy, some discrepancies in the amounts of the solution of each disinfectant required to destroy the vitality of the *B. coli*, but it must be remembered that in each experiment (the experiments being performed at intervals of 7 days) a different specimen of fæces and of urine was used, so that these discrepancies appear to indicate the variations in the natural media which may obtain in actual practice. A striking point well brought out by the experiments is the resistance offered by the streptococcus of fæces to the disinfectants. This was still better seen in the Conradi plates of the earlier experiments.

The variable results obtained by us are not the least suggestive feature of the experiments, especially when it is borne in mind that they were all obtained independently at King's College and University College from the same materials and upon the same days.

The results of the foregoing sets of experiments may be tabulated as follows, as regards the disinfecting values of the disinfectants employed:—

TABLE 5.

	Izal.		Cyllin.		Phenol.		Phenyle.	
	Fæces	Urine.	Fæces.	Urine.	Fæces.	Urine.	Fæces.	Urine.
Maximum amount of Disinfectant solution, in cc.'s, which permits the *B. coli* to develop when added to 25 cc. of material ...	2·5	1·0	2·5	1·0	6·0	4·0	5·5	2·0
Hence, amount of Disinfectant solution, in cc.'s, necessary to ensure the destruction of *B. coli* under the conditions of the experiments	3·0	1·5	3·0	1·5	6·5	4·5	6·0	2·5

In each case it will be seen that more of the disinfectant is required to destroy the *B. coli* in fæces than in urine.

If we state these results as a series of co-efficients with carbolic acid as the standard, taking the maximum amounts of disinfectants which permitted growth, we obtain:—

TABLE 6.

	Fæces.	Urine.
Izal	2·4 ...	4·0
Cyllin	2·4 ...	4·0
Phenyle	1·1 ...	1·8
Phenol	1·0 ...	1·0

TABLE 7.

No. of Experiment.	Amount in cc.'s of Disinfectant added.	Results. Izal.	Cyllin.	Phenyle.	Phenol.
1	0·25	A+G	A+G	A+G	—
	0·5	A+G	A+G	A+G	A+G
	0·75	A+G	A+G	—	—
	1·0	A+G	A+G	A+G	A+G
	1·5	O	A+G	A+G	A+G
	2·0	—	—	A+G	A+G
	2·5	—	—	—	A+G
2	1·0	O	—	—	—
	1·5	O	O	—	—
	2·0	O	O	—	—
	2·5	—	O	O	—
	3·0	—	—	O	A+G
	3·5	—	—	O	A+G
	4·0	—	—	—	O
3	0·75	A+G	A+G	—	—
	1·0	O	A+G	—	—
	1·25	O	O	—	—
	1·5	O	A+G	A+G	—
	1·75	O	A+G	A+G	—
	2·0	—	—	A+G	—
	2·25	—	—	A+G	—
	2·5	—	—	A+G	—
	3·0	—	—	—	A+G
	3·25	—	—	—	A+G
	3·5	—	—	—	A+G
	3·75	—	—	—	A+G
	4·0	—	—	—	A+G
4	1·0	A+G	—	—	—
	1·5	O	O	—	—
	2·0	O	O	A+G	—
	2·5	O	O	A+G	—
	3·0	—	O	A+G	A+G
	3·5	—	—	A+G	A+G
	4·0	—	—	—	A+G
	4·5	—	—	—	A+G
5	1·0	O	O	—	—
	1·5	O	O	—	—
	2·0	O	O	—	—
	3·0	—	—	A+G	—
	3·5	—	—	A+G	A+G
	4·0	—	—	A+G	A+G
	4·5	—	—	A+G	A+G
	5·0	—	—	A+G	A+G
6	4·5	—	—	A+G	A+G
	5·0	—	—	O	A+G
	5·5	—	—	O	A+G
	6·0	—	—	O	A+G
7	5·5	—	—	—	A+G
	6·0	—	—	—	O
	6·5	—	—	—	O

A + G = Acid + Gas; O = no change; — = this quantity not tested.

Having thus obtained carbolic acid co-efficients for the three disinfectants employed, by this method, on fæces and urine, we next proceeded to determine carbolic acid co-efficients (1) by a modification of the method, using sterile tap-water and a pure cultivation of the *Bacillus coli*, instead of the naturally infected urine and fæces; and (2) by the Rideal-Walker method.

The cultivation of the *Bacillus coli* used was one which had been isolated in our previous experiments and was only the second sub-culture, so that it may probably be regarded as being practically in the same condition as it existed in the original natural material. In the first series of experiments 24 cc. of sterile tap-water were introduced into a number of sterile Erlenmeyer flasks, 1 cc. of a twenty hours' broth culture of the *B. coli* was added, and then varying amounts of the disinfectant solutions (the original 5 per cent. solutions as used for all the experiments) were added, and at the expiration of half an hour sub-cultures were made into glucose bile-salt peptone water tubes. Before the disinfectants had been added, a few controls were made and gave luxuriant growths of the *B. coli*. Table 7 shows the results obtained.

If these results be compared with those tabulated in Tables 5 and 6, it will be seen that there is a fair correspondence with those given by izal and cyllin, in the urine experiments, but that phenyle and phenol appear to be weaker. This may perhaps be due to the presence of the salts of urine enhancing their action. This again emphasises the difference between testing a disinfectant by artificial methods and experimenting upon an organism in its natural environment.

If the carbolic acid co-efficients be calculated the following will be obtained:—

		Carbolic Acid Co-efficient.		
Izal	...	$\frac{6}{1}$	=	6·0
Cyllin	...	$\frac{1}{6\cdot5}$	=	4·0
Phenyle	...	$\frac{6}{5}$	=	1·2
Phenol	...	—	=	1·0

The following tables show the results obtained with the Rideal-Walker method, the original 5 per cent. solutions of the disinfectants being used for making the dilutions employed:—

TABLE 8.—*Dec. 19th, 1905. B. coli, 20 hours' broth culture at 37° C.*

+ = growth; • = no growth in the sub-cultures.

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Phenyle	1—200	+	+	+	+	+	+	Dec. 20th	37° C.
"	1—250	+	+	+	+	+	+		
"	1—300	+	+	+	+	+	+		
"	1—400	+	+	+	+	+	+		
Carbolic	1—90	+	+	+	+	+	+		

TABLE 9.—*Dec. 19th, 1905. B. coli, 20 hours' broth culture at 37° C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Cyllin	1—400	+	+	+	+	•	•	Dec. 21st	37° C.
"	1—500	+	+	+	+	+	•		
"	1—600	+	+	+	+	+	+		
"	1—700	+	+	+	+	+	+		
Carbolic	1—95	+	+	+	+	+	+		

TABLE 10.—*Dec. 19th, 1905. B. coli, 20 hours' broth culture at 37° C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Izal	1—400	+	+	+	•	•	•	Dec. 21st	37° C.
"	1—500	+	+	+	+	+	+		
"	1—600	+	+	+	+	+	+		
"	1—700	+	+	+	+	+	+		
Carbolic	1—100	+	+	+	+	+	+		

TABLE 11.—*Dec. 21st, 1905. B. coli, 20 hours' broth culture at 37° C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Cyllin	1—360	+	+	•	•	•	•	Dec. 23rd	37° C.
"	1—380	+	+	•	•	•	•		
"	1—400	+	+	•	•	•	•		
Carbolic	1—70	+	•	•	•	•	•		
"	1—75	+	+	•	•	•	•		

Carbolic Acid Co-efficient of Cyllin $= \frac{400}{75} = 5\cdot 3$.

TABLE 12.—*Dec. 21st,* 1905. *B. coli,* 20 *hours' broth culture at* 37° *C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Izal	1—340	•	•	•	•	•	•	Dec. 23rd	37° C.
„	1—360	+	•	•	•	•	•		
„	1—380	+	•	•	•	•	•		
„	1—400	+	•	•	•	•	•		
Carbolic	1—80	+	+	+	+	•	•		

Carbolic Acid Co-efficient of Izal (from XI. & XII.) $= \frac{400}{70} = 5{\cdot}7$.

TABLE 13.—*Dec. 21st,* 1905. *B. coli,* 20 *hours' broth culture at* 37° *C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Phenyle	1—120	+	+	+	+	+	+	Dec. 23rd	37° C.
„	1—140	+	+	+	+	+	+		
„	1—160	+	+	+	+	+	+		
„	1—180	+	+	+	+	+	+		
Carbolic	1—85	+	+	+	+	+	+		

TABLE 14.—*Dec. 22nd,* 1905. *B. coli,* 20 *hours' broth culture at* 37° *C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Izal	1—400	+	+	•	•	•	•	Dec. 27th	37° C.
„	1—420	+	+	+	•	•	•		
„	1—440	+	+	+	+	•	•		
Carbolic	1—75	+	+	+	•	•	•		
„	1—80	+	+	+	+	+	•		

TABLE 15.—*Dec. 22nd,* 1905. *B. coli,* 20 *hours' broth culture at* 37° *C.*

Disinfectant.	Dilution.	Time culture exposed to action of disinfect. in mins.						Sub-Cultures (Broth).	
		2½	5	7½	10	12½	15	Period of Incub.	Temp.
Phenyle	1—90	+	+	+	•	•	•	Dec. 27th	37° C.
„	1- 100	+	+	+	+	+	+		
„	1—110	+	+	+	+	+	+		
Cyllin	1—400	+	+	+	+	+	+		
„	1—420	+	+	+	+	+	+		

The Carbolic Acid co-efficient of Phenyle (from XIV. and XV.) $= \frac{90}{75} = 1{\cdot}2$.

Laboratory temperatures about 16° C.

By the Rideal-Walker method, therefore, we obtain the following figures as the carbolic acid co-efficients.

	Carbolic Acid Co-efficient.
Izal	5·7
Cyllin	5·3
Phenyle	1·2
Phenol	1·0

We may now compare the co-efficients obtained by all the methods:—

	Fæces.	Urine.	Water.	Rideal-Walker.
Izal ...	2·4	4·0	6·0	5·7
Cyllin ...	2·4	4·0	4·0	5·3
Phenyle ...	1·1	1·8	1·2	1·2
Phenol ...	1·0	1·0	1·0	1·0

It will be noted that the difference in the efficiency of the disinfectants tested is not so great by the more direct and practical method as when tested by the Rideal-Walker method, and that whereas by the latter method izal and cyllin have co-efficients exceeding 5, the experiments upon the same germs in fæces yield co-efficients of less than half this figure.

The difference between the carbolic acid co-efficients calculated from the experiments upon fæces and water, respectively, serve to indicate the extent of the resistance presented by the organic matter in the former, which, it will be seen, had the effect of reducing the co-efficient of izal and cyllin some 60 % and 40 %, respectively.

The margin of safety is a very important question. In engineering, where far more exact calculations can be made than in biological problems, it is usual to allow a very large factor of safety, and it seems to us that the same should be done with regard to disinfection. Having obtained the minimum amount of a disinfectant which is required to kill under standard conditions, for practical disinfection probably at least double this amount ought to be used, if not a still larger multiple.

What is the margin which may be held to represent the variation between the killing power of these disinfectants in the variable kinds of typhoid fæces? These experiments help us to form some conception of what this margin may be, as the stools employed in each set of experiments were taken from different patients in varying stages of the disease, and their physical characters presented almost the limits of variation.

If we compare the weakest strengths of the different disinfectants with

the strongest which were found necessary to effect the object aimed at we find that there is a variation of about 25 per cent. in respect of izal and cyllin, and about 40 per cent. in respect of phenol.

It appears then that in order that the strengths at which disinfectants ought to be used in practice may be stated with safety it is not only *necessary* to take into account the different kinds of natural media with which the organisms may be associated but also the variable nature which these different natural media may assume. If, for instance, an experiment is made upon a particular typhoid stool, whatever may be ascertained to be the killing strength of a disinfectant upon the organisms in that stool, a further allowance would have to be made in order to take into account the variable physical characters which other stools are capable of assuming. The extent of this allowance is ascertainable by experiments, and it is not difficult to arrive at a fair approximation to the truth. It should, therefore, be ascertained of any disinfectant which it is proposed to adopt for general practice, and we would suggest that it would suffice if it were ascertained with reference to both *Bacillus typhosus* and *Bacillus tuberculosis* in the different kinds of organic matter with which they may respectively be associated. To this "margin of safety" should be superadded a further allowance, or margin of safety, to meet the accidents of practice.

It is upon these lines only that the necessary strength of a particular disinfectant, in order to meet the requirements of actual practice, can be determined; and it is only upon such lines, therefore, that a carbolic acid co-efficient should be arrived at.

PARTICULARS OF THE CASES IN THE TYPHOID WARDS OF A LARGE HOSPITAL FURNISHING MATERIAL FOR EXPERIMENTS.

M. D. .... Spots. Spleen definitely enlarged. Temperature tending to be irregularly intermittent.

L .... Spots. Spleen not definitely enlarged. Tenderness of abdomen. Temperature, 5 weeks sustained and remittent.

H .... Spots. Spleen enlarged. Temperature, 5 weeks sustained and remittent.

T .... Spots. No note on Spleen. Temperature sustained and remittent for some weeks. Distension and diarrhœa.

M..................	No spots. Spleen not definitely enlarged. Temperature sustained and remittent.
P.........(1st attack)	No spots. No note on Spleen. Pain in abdomen. Temperature well sustained and remittent, 3 weeks.
P ....(relapse)	Spots. Spleen, no definite enlargement. Temperature well sustained and remittent for 3 weeks.
J	Spots. No Spleen symptom. Temperature well sustained and remittent.
L	Spots. No notes on Spleen. Abdominal tenderness. Temperature well sustained and remittent.
D	Spots. Spleen not definitely enlarged. Temperature (18th day of illness) intermittent.
B	Spots. Spleen enlarged. Temperature sustained and intermittent.
B	Spots. No note on Spleen. Temperature sustained and intermittent.
M...................	Spots. Spleen not definitely enlarged. Temperature fairly well sustained and remittent.
W. D.	Spots. Spleen not definitely enlarged. Temperature well sustained and remittent.
N	Spots. Spleen not definitely enlarged. Temperature well sustained and remittent.
W	Spots. Spleen enlarged. Abdomen distended. Sustained temperature. Stools loose and ochre coloured.

PARTICULARS AS TO THE FÆCES AND URINE FROM THE ABOVE CASES AS THEY WERE EMPLOYED IN THE EXPERIMENTS.

Fæces. Patient's Initials.	Fæces. Day of Disease.		Urine. Patient's Initials.	Urine. Day of Disease.	
First Experiment—October 10th.					
D.....	20th (firm stool)	Mixed.	D.	20th	Mixed.
L.....	22nd do.		H.	39th	
Second Experiment—October 17th.					
T.....	14th (firm stool)	Mixed.	M.	12th	Mixed.
M....	12th (fluid green stool)		P. ..(12th of relapse)	50th	
			J.	58th	
			L.	61st	

Fæces. Patient's Initials.	Fæces. Day of Disease.		Urine. Patient's Initials.	Urine. Day of Disease.	
Third Experiment—October 24th.					
D.	19th (fluid ochre stool)	Mixed.	L.	36th	Mixed.
B.	15th do.		B.	77th	
P.	57th do.		T.	28th	
			P. ..(19th of relapse)	57th	
			D.	34th	
Fourth Experiment—October 31st.					
D.	11th (firm stool)	Mixed.	L.	43rd	Mixed.
N.	14th do.		B.	84th	
M.	11th do.		T.	35th	
B.	22nd do.		P.	26th	
			D.	41st	
Fifth Experiment—November 7th.					
N.	21st	Mixed. Mixture was fluid and ochre coloured.	L.	50th	Mixed.
M.	18th		B.	91st	
B	29th		T.	42nd	
			P.	33rd	
			D.	48th	
Sixth Experiment—November 14th.					
M	25th	One firm, the other fluid ochre coloured. Mixed.	L.	57th	Mixed.
N	28th		B.	98th	
			P.	40th	
			D.	57th	
Seventh Experiment—November 21st.					
N.	35th	Mixed.	P.	47th	Mixed.
P.	47th		N.	35th	
D.	32nd		L.	64th	
			B.	105th	
Eighth Experiment—November 28th.					
W.	15th		D.	40th	Mixed.
			W.	15th	

SPECIAL COMMITTEE APPOINTED BY THE ROYAL SANITARY INSTITUTE.

DISINFECTANT STANDARDISATION COMMITTEE.

In the course of their consideration of the above subject, the following Report of Experiments made on behalf of this Committee has been submitted to them by Lieut.-Col. R. H. FIRTH, F.R.C.S., D.P.H., R.A.M.C., *and* Professor ALLAN MACFADYEN, M.D., B.SC., F.I.C.

FOR the further elucidation of the question as to what method is best adapted for the routine standardisation of disinfectants, your Committee requested us to carry out additional experiments to those which have already been submitted.

The accompanying schedule presents the results of a large number of observations which have been made under our supervision by Major C. E. P. Fowler, R.A.M.C., in the hygiene laboratory of the Royal Army Medical College on behalf and at the expense of The Royal Sanitary Institute.

The general plan of these experiments has been to test the comparative value of three methods, namely "the Garnet," "the Thread," and the "Drop," using as test micro-organisms (1) spore bearing anthrax bacilli, (2) various strains of the *B. typhosus*, and (3) the *B. prodigiosus*. The selection of these particular varieties of bacterial life was made because they respectively represent a typical resistant pathogenic form, a typical fæcal pathogenic micro-organism, and a typical saprophytic microbe. A few observations have been made with the cholera vibrio. Further, the experiments have been carried out to determine, if possible, whether bichloride of mercury could be utilised as the standard reagent in place of phenol, as had been suggested previously, and also to test the three methods with a variety of commercial disinfectants in common use.

The "Garnet" method employed is a modification of that suggested by Kronig and Paul, and has been described already in the proceedings of your Committee. When working with bichloride of mercury, the garnets were washed with sterile saturated ammonium sulphide solution, but when other disinfectants were used, the garnets were washed only in sterile distilled water before being transferred to the broth sub-culture tubes.

The "Thread" method has been carried out in the following way:

Apparatus required:—

60 sterile watch glasses.
30 tubes of nutrient broth.
1 sterile test tube.
1 sterile glass funnel.
1 sterile filter paper.
30 sterile silk threads, one inch in length of standard calibre. The standard employed has been Pearsall's flannel embroidery, silk size No. 4 (extra stout), cream colour.
1 empty sterile Petri dish.
2 sterile Petri dishes, each containing two sterile filter papers.
Some sterile distilled water.
2 twenty-four-hour agar growths of micro-organisms under observation.

Technique.—An emulsion of the micro-organisms is made by adding 5 cc. of sterile distilled water to each of the agar slope growths and carefully scraping off the growths by means of a platinum wire loop, followed by gentle agitation. The resulting emulsions are then filtered through the sterile filter paper into the sterile test tube. The filtrate there collected is now poured into the sterile Petri dish, and 30 silk threads (of standard length and thickness) soaked in the filtered emulsion for one hour at 37° C. After soaking for an hour, each thread is transferred separately by means of sterile forceps to the two other Petri dishes, which have the filter paper covering their bottom. Excess of emulsion is thus absorbed, and the two dishes, with their contained infected threads, allowed to dry by placing them in the 37° C. incubator for 20 hours.

Diagram illustrating the working of the "Thread" Method.

Nature and Dilution of Reagent employed.	Group I. of watch glasses containing diluted Disinfectant. Period of Contact in minutes.						Group II. of watch glasses containing Water, or Sulphide for washing the threads.					
	2½	5	7½	10	12½	15						
X disinfectant 1-400 E.	o	o	o	o	o	o	o	o	o	o	o	o
" " 1-300 D.	o	o	o	o	o	o	o	o	o	o	o	o
" " 1-200 C.	o	o	o	o	o	o	o	o	o	o	o	o
" " 1-100 B.	o	o	o	o	o	o	o	o	o	o	o	o
Phenol " 1-80 A.	o	o	o	o	o	o	o	o	o	o	o	o

The 30 broth tubes are arranged in a convenient rack or stand, and marked as belonging to one or other of five groups, A, B, C, D, and E, that is, each group contains six tubes. Each tube is further marked with a number signifying the contact period in minutes. Then, if a maximum 15 minutes contact be decided upon the tubes would be variously marked, A2½, A5, A7½, A10, A12½, A15, B2½, B5, B7½, and so on.

The 60 sterile watch glasses are now arranged in rows, as evident from the accompanying diagram, and divided into two groups of 30 each, namely, Group I. and Group II. Each group contains five rows of six watch glasses. Into those of Group I., sufficient disinfectant solution (of varying dilution) is placed to fill each watch glass. The rows in the group being distinguished by the letters A, B, C, D, E, from below upward. Each row of watch glasses in Group I. will contain a definite dilution of any given disinfectant. Thus, in the diagram, the lower or A row is shown to contain phenol (1 in 80), while the other rows B to E contain varying dilutions of whatever reagent is under comparison. The vertical rows of watch glasses are marked with figures corresponding to those on the broth tubes in the rack, and representing whatever period of time the thread is left in contact with the disinfectant. This is conveniently expressed in minutes.

The watch glasses in Group II. are similarly arranged, but all filled with sterile distilled water, or when working with bichloride of mercury, with sterile ammonium sulphide solution.

Single prepared threads from the Petri dishes in which they have been drying are now placed as quickly as possible in each of the watch glasses of row A in Group I. In half-a-minute from the start, or at such interval of time as has been decided upon for the experiment, other single prepared threads from the Petri dishes are placed in the glasses of B row of Group I., and so on until each watch glass in Group I. has received a thread. Assuming that the experiment has been planned for half-a-

minute interval, a period of 2½ minutes will have elapsed between the transfer of a thread into the first watch glass of row A and of one into the last glass of row E. The thread from the first glass in row A of Group I. is now rapidly transferred by means of sterile forceps to its corresponding watch glass in row A of Group II., and agitated in the water or ammonium sulphide, as the case may be, and left there. On the elapse of half-a-minute from the commencement of this transfer of thread from glass A2½ I. to A2½ II., the thread from B2½ I. is transferred to and washed in its corresponding watch glass in row B of Group II. The thread left in A2½ II. is now rapidly placed in its corresponding broth tube marked A2½. This is readily performed in the half-minute, which makes it time to transfer the thread from C2½ of I. to its corresponding watch glass in row C of II. So soon as this is done, the thread which has been left and washed in the glass B2½ of Group II. is transferred to its corresponding broth tube marked B2½. Another half-minute will now nearly have elapsed, and so soon as it has elapsed, the thread from the first glass of row D in Group I. must be transferred to its corresponding watch glass in row D of Group II. and so on. As soon as the thread in the first glass of row E1 has been washed, and that of D2½ transferred to its own broth sub-culture tube, five minutes will have elapsed from the commencement of the transfer of threads to the first glass in A1 row, and it will be time to deal with the thread in the second glass of row A1. In this manner, with half-minute intervals, the whole series of threads can be exposed to varying periods of contact in different dilutions of disinfectant, duly washed and transferred to broth for sub-culture. The interval can be made to vary according to the needs of the operator.

On completion of the whole experiment, the broth tubes, each containing a thread, are incubated at a temperature suitable for the micro-organisms employed, and the results duly recorded. In experiments with anthrax spores the incubation has been maintained for a week, with *B. typhosus* two days, and with *B. prodigiosus* five days.

This thread method presents many points of similarity in the matter of its general design to the "Drop" method as devised by Rideal and Walker. In actual practice its working is easier than the verbal description may imply.

The "Drop" method employed in these experiments is that described already by Rideal and Walker.*

In all the experiments, irrespective of method, the following conditions have been observed:—(1) The observations have been made at room

* Journal of Sanitary Institute, Vol. xxiv., 1903, p. 424.

temperature, the same being duly recorded; (2) the nutrient broth has been made invariably from chopped fresh meat with the addition of peptone and salt, the finished medium having a standard reaction of + 15 All tubes of nutrient broth contained 10 cc. of the fluid.

With the exception of experiments, Nos. 102, 103, 104, 105, 120, 130 to 140, in which 24 hour broth cultures were used, all the observations with *B. typhosus* and *B. prodigiosus* have been made by adding to the various dilutions of the disinfectant a filtered emulsion of the organism, made by scraping the growth off a 24-hour old agar slope culture and emulsifying in 5 cc. of sterile distilled water, subsequent filtration and breaking down of lumps being secured by passing through a sterile filter paper in a sterile glass funnel. In the case of anthrax cultures, these were all seven day old growths and always contained spores, as verified by microscopical examination. The subsequent preparation of the emulsion has been explained.

In the "Drop" method experiments with bichloride of mercury, the tubes of broth for sub-culture have in the majority of cases received two drops of sterile saturated ammonium sulphide solution. The addition or withholding of the sulphide to the broth in each experiment is noted in the schedule in the column devoted to method. In the same column is noted also the temperature at which the experiment was carried out.

Practically, throughout the series of "Drop" experiments, the same circular platinum loop has been used for inoculating the sub-cultures; the size of the loop being 3 mm. in diameter, and the calibre of the wire 0·4 mm.

With the exception of experiments Nos. 131, 133, and 140, in all the "Drop" method observations, the platinum needle with loop has been boldly passed into and agitated in the mixture of disinfectant and culture. In the case of the three exceptions named, the platinum loop was allowed only to drop gently below the surface of the fluid.

With the exception of experiment No. 137, one drop of infecting emulsion or broth culture has been added for each cubic centimetre of diluted disinfectant, and, as in all cases, 5 cc. of diluted disinfectant has been used, each of these tubes has received five drops of infective material. In the exception quoted, 1 cc. of the infective fluid was added to 5 cc. of the diluted reagent, and the figures in the schedule showing the dilution of the reagent employed in the experiment are those of the actual and final dilution, after the addition of the extra volume of infecting fluid.

In experiments Nos. 92, 124, 126, 127, and 128, the efficiency of the reagent in the presence of organic material was tested, by making the

required dilutions of the reagent, not with sterile distilled water only, but with four parts of sterile water and one part of sterile urine.

While fully recognising that the precise interpretation to be placed upon these scheduled experiments rests with your Committee, we venture to express our own views as to the conclusion which we ourselves think may be deduced from the work of Major Fowler.

As to the "Garnet" method, we think the results are too irregular to justify its adoption as a means of obtaining any comparative figure of disinfecting efficiency.

By the "Thread" method we are of opinion that a co-efficient or measure of comparative efficiency can be obtained, but the experiments so far made indicate that such coefficient (*quâ* phenol) will be lower than that obtained by the drop method. This does not militate against its value, as this lower figure appears to be constant for all commercial disinfectants; it is a point, however, to be noted, as it is quite clear from the results before us that a given disinfectant may have say a phenol coefficient against a particular micro-organism of nine or ten by the drop method, and but one or two by the thread method. The importance of stating by what method the co-efficient has been obtained in any given case will be obvious.

We consider the technique of the "Thread" method to be so elaborate that, no matter what may be its merits, its adoption as a standard procedure seems impossible. It is eminently unfitted for working with micro-organisms at all sensitive to desiccation; see experiments Nos. 59 and 60.

In working the "Thread" method with ordinary disinfectants other than bichloride of mercury, it was found necessary to double the contact period, as will be seen by reference to experiments Nos. 26 to 60, all of which show twice the contact period as compared with experiments 16 to 25.

Provided the operator works in a room free from obvious draughts or air currents, in spite of the apparent risks of contamination by exposure of the watch glasses to the air, we find that chances of error and vitiation of sub-cultures by contamination are so remarkably small as to constitute a negligable factor.

As to the "Drop" method, we consider that, for general simplicity and facility of working, it is superior to both the garnet and thread methods, yielding in most instances results which are sharper or more definite. It must, however, be noted that even with this method difficulties are met with in securing clear and sharp results; the disturbing factors being

variations in temperature rather than variations in the strain of the same species of micro-organisms employed, and any slight differences in personal technique.

The question of temperature is very important, as the higher or lower temperature of the room in which a given experiment is carried out materially affects the efficient action of certain disinfectants, particularly phenol and the phenoloids. We anticipate some difficulty in insisting upon any precise temperature at which this class of observation should be made, but we suggest that consideration be given to the point whether a range of from 60° to 65° F. should not be laid down as desirable in standardisation experiments.

The influence of variations in strain of micro-organisms is a difficult one, and too much importance must not be attached to it, as the experiments, submitted herewith, show that the behaviour of several strains of *B. typhosus* in the presence of various disinfectants in corresponding solutions is remarkably similar. We are impressed with the fact that different strains of *B. typhosus* present certain differences as to tendency to clump, and for this reason admit some predilection for the employment of filtered cultures of this micro-organism, but the error from this source we think is small, provided that due care be taken to see that the particular strain employed is normal in all its cultural features. It is noticeable that the results with *B. prodigiosus* are largely concordant, and we suggest the advisability of your Committee considering whether it might not be advisable to employ a simple saprophytic micro-organism possessing well known stable cultural features, such as the *B. prodigiosus* as the standard against which to test the comparative efficiency of different disinfectants. The phenol coefficient of many commercial disinfectants in relation to this micro-organism appears to be nearly the same as that given when *B. typhosus* has been used in standardisation experiments.

An extended experience of the "Drop" method impresses us with the view that no coefficient should be deduced from any particular experiment unless there are at least two negative results in the phenol or comparative reagent line. Further, that before stating that any given disinfectant has a definite coefficient as against a particular micro-organism by this or any other method, the same result should be obtained in not less than three out of five observations, and with more than one sample of the reagent.

We are strongly of opinion that the practical value of any statement regarding a disinfectant would be enhanced if a duplicate series of experiments be made, using for its various dilutions not simple sterile water, but

sterile water containing some organic matter as represented by the addition of sterile urine. The importance of this point is manifest in experiments Nos. 92, 124, 126, 127, and 128, in which the phenol coefficient of certain reagents differs markedly according as to whether organic matter be present or not.

As an alternative method, we direct attention to experiments 141 to 155, in which, in place of testing the disinfectants against "naked" bacteria, that is pure cultures suspended in either sterile water or broth, the reagents have been tested against an emulsion of fresh fæces and urine. This has been prepared by rubbing up one gramme of fresh fæces in a mortar with 100 cc. of fresh urine, the whole being roughly strained by passage through an ordinary filter paper to remove clumps. This mixture contains many micro-organisms, and approximates in general character to the material against which disinfectants would be generally used in daily practice. Three cubic centimetres of this fœculent emulsion were placed in the test tubes, and an equal volume of various dilutions of the disinfectants added, the subsequent technique being that usual in carrying out the "Drop" method. The dilutions shown in the detail of experiments are those actually resulting after adding an equal volume of diluted re-agent to the fæculent fluid. Thus, where a dilution of 1 in 100 is shown, it means that three cubic centimetres of a 1 in 50 dilution of a given disinfectant were added to a similar volume of urine and fæces, the final dilution being then 1 in 100. If the results be read off and taken after 24 hours' incubation, remarkably constant and sharp results are obtainable, and quite as good as those obtained when working against "naked" bacteria. If the results be taken after a more prolonged incubation irregular readings are obtained, owing to the development of adult forms from pre-existing spores; but if the result be taken at 24 hours, the effects are recorded only so far as relates to non-sporing micro-organisms. The procedure entails little or no extra trouble, and has the advantage of standardizing the disinfectant against a natural mixture of bacteria, resembling the material against which the reagents are likely to be used in medical practice.

The evidence in favour of the superiority of phenol over bichloride of mercury, as the standard reagent for comparison, appears to us to be overwhelming.

In conclusion, we wish to place on record our appreciation of the time and labour which Major Fowler has given to this inquiry.

R. H. Firth.
Allan Macfadyen.

November 24th, 1905.

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
1	Garnet 62° F.	Anthrax, spore-bearing	$HgCl_2$	1:1100	+	...	...	...	...	...	7 days at 37° C.
				1:1050	+	+	+	+	...	...	
				1:1000	+	...	...	...	...	+	
				1:950	...	+	...	+	...	...	
				1:900	...	+	...	...	...	...	
2	Garnet 62° F.	Anthrax, spore-bearing	$HgCl_2$	1:1100	+	+	+	...	...	...	7 days at 37° C.
				1:1050	+	+	+	...	+	...	
				1:1000	+	+	+	...	...	...	
				1:950	+	+	+	...	...	...	
				1:900	+	+	...	...	+	...	
3	Garnet 60° F.	Anthrax, spore-bearing	$HgCl_2$	1:1100	+	...	...	...	...	...	7 days at 37° C.
				1:1050	+	...	...	...	...	...	
				1:1000	+	...	...	...	...	...	
				1:950	+	...	...	...	...	...	
				1:900	+	...	..	...	...	...	
4	Garnet 61° F.	Anthrax, spore-bearing	$HgCl_2$	1:250	+	+	+	...	...	...	7 days at 37° C.
				1:200	+	...	...	...	...	...	
				1:175	+	...	...	...	...	...	
				1:150	+	...	...	...	...	...	
				1:125	...	+	...	...	...	...	
5	Garnet 62° F.	Anthrax, spore-bearing	$HgCl_2$	1:250	+	+	...	...	...	...	7 days at 37° C.
				1:200	...	...	...	...	...	...	
				1:175	...	...	...	...	...	...	
				1:150	...	+	...	...	...	...	
				1:125	...	...	...	...	...	...	
6	Garnet 60° F.	Anthrax, spore-bearing	$HgCl_2$	1:500	+	...	+	...	...	...	7 days at 37° C.
				1:400	+	...	+	...	...	...	
				1:300	+	...	...	...	...	...	
				1:200	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
7	Garnet 59° F.	Anthrax, spore-bearing	$HgCl_2$	1:150	...	...	+	...	...	...	7 days at 37° C.
				1:125	...	+	+	...	...	...	
				1:100	+	+	+	+	...	...	
				1:75	+	...	...	+	...	...	
				1:50	...	...	...	...	+	...	
8	Garnet 61° F.	B. typhosus	$HgCl_2$	1:25000	...	...	+	+	...	...	2 days at 37° C.
				1:20000	+	+	+	...	...	+	
				1:15000	+	+	...	...	...	...	
				1:10000	...	...	...	...	...	...	
			Phenol	1:120	+	+	+	+	...	...	
9	Garnet 63° F.	B. typhosus	$HgCl_2$	1:30000	+	+	+	+	+	+	2 days at 37° C.
				1:25000	+	...	...	...	...	+	
				1;20000	+	+	+	...	...	...	
				1:15000	...	...	+	...	...	...	
			Phenol	1;120	+	+	...	...	...	. .	
10	Garnet 62° F.	B. typhosus	$HgCl_2$	1:35000	...	+	+	...	...	...	2 days at 37° C.
				1:30000	...	...	...	+	...	...	
				1:25000	...	+	...	...	...	+	
			Phenol	1:120	+	+	+	+	...	+	
			„	1:100	+	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
11	Garnet 63° F.	B. typhosus	Liq. cresyl sap. (J.)	1 : 1150	...	...	...	...	...	...	2 days at 37° C.
				1 : 1100	...	...	...	...	...	...	
				1 : 1050	...	...	+	...	...	...	
				1 : 1000	+	...	...	...	...	...	
			Phenol	1 : 90	...	...	...	...	...	...	
12	Garnet 60° F.	B. typhosus	Liq. cresyl sap. (J.)	1 : 960	+	...	...	+	...	...	2 days at 37° C.
				1 : 920	+	+	...	...	...	+	
				1 : 880	...	...	...	...	...	...	
				1 : 840	+	...	...	...	+	...	
			Phenol	1 : 80	...	+	...	...	...	...	
13	Garnet 60° F.	B. prodigiosus	Phenol	1 : 110	+	+	+	+	...	...	4 days at 22° C.
				1 : 100	+	...	...	...	...	...	
				1 : 90	...	...	+	...	...	...	
				1 : 80	...	+	...	...	...	...	
				1 : 70	...	...	+	...	...	...	
14	Garnet 58° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1 : 1150	+	+	+	...	...	+	4 days at 22° C.
				1 : 1000	...	+	+	...	...	+	
				1 : 1050	+	+	...	...	+	...	
				1 : 1000	...	+	...	...	...	...	
			Phenol	1 : 90	...	...	...	...	...	...	
15	Garnet 62° F.	B. prodigiosus	Phenol	1 : 120	+	...	...	+	+	...	4 days at 22° C.
				1 : 100	+	...	+	+	+	...	
				1 : 100	...	...	+	...	...	+	
				1 : 90	+	+	...	+	...	...	
				1 : 80	+	+	...	...	+	...	
16	Thread 62° F. NH_4HS used	Anthrax, spore-bearing	$HgCl_2$	1 : 1100	+	+	+	+	+	+	7 days at 37° C.
				1 : 1050	+	+	+	+	+	+	
				1 : 1000	+	+	+	+	+	+	
				1 : 950	+	+	+	+	...	+	
				1 : 900	+	+	+	+	+	...	
17	Thread 64° F. NH_4HS used	Anthrax, spore-bearing	$HgCl_2$	1 : 1100	+	+	+	+	+	+	7 days at 37° C.
				1 : 1050	+	+	+	+	+	+	
				1 : 1000	+	+	+	+	+	...	
				1 : 950	+	+	+	+	...	...	
				1 : 900	+	+	+	+	...	...	
18	Thread 65° F. NH_4HS used	Anthrax, spore-bearing	$HgCl_2$	1 : 700	+	+	...	...	...	...	7 days at 37° C.
				1 : 600	+	+	...	...	...	...	
				1 : 500	+	...	...	...	...	...	
				1 : 400	+	...	...	...	...	...	
				1 : 300	...	...	...	...	...	...	
19	Thread 64° F. No NH_4HS	Anthrax, spore-bearing	$HgCl_2$	1 : 550	+	...	...	...	...	...	7 days at 37° C.
				1 : 450	+	...	...	...	...	...	
				1 : 350	...	...	...	...	...	...	
				1 : 250	...	...	...	...	...	...	
				1 : 150	...	...	...	...	...	...	
20	Thread 62° F. NH_4HS used	Anthrax, spore-bearing	$HgCl_2$	1 : 700	+	...	+	+	...	...	7 days at 37° C.
				1 : 600	+	+	...	...	...	...	
				1 : 500	+	...	+	...	...	...	
				1 : 400	...	...	...	...	...	...	
				1 : 300	...	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					2½	5	7½	10	12½	15	
21	Thread 58° F.	B. typhosus (O)	Phenol	1:105	+	+	+	+	+	+	2 days at 37° C.
				1:100	+	+	+	+	+	+	
				1:95	+	+	+	+	+	+	
				1:90	+	+	+	+	+	+	
				1:85	+	+	+	+	+	+	
22	Thread 60° F.	B. typhosus (O)	Phenol	1:80	+	+	+	+	+	+	2 days at 37° C.
				1:75	+	+	+	+	+	+	
				1:70	+	+	+	+	+	+	
				1:65	+	+	+	+	+	+	
				1:60	+	+	+	+	+	+	
23	Thread 62° F.	B. prodigiosus	Phenol	1:120	+	+	+	+	+	+	4 days at 22° C
				1:115	+	+	+	+	+	+	
				1:110	+	+	+	+	+	+	
				1:100	+	+	+	+	+	+	
				1:90	+	+	+	+	+	+	
24	Thread 60° F.	B. prodigiosus	Phenol	1:80	+	+	+	+	+	+	4 days at 22° C.
				1:75	+	+	+	+	+	+	
				1:70	+	+	+	+	+	+	
				1:65	+	+	+	+	+	+	
				1:60	+	+	+	+	+	+	
25	Thread 60° F.	B. prodigiosus	Phenol	1:55	+	+	+	+	+	+	4 days at 22° C.
				1:50	+	+	+	+	+	+	
				1:45	+	+	+	+	+	+	
				1:40	+	+	+	+	+	+	
				1:35	+	+	+	+	+	+	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					17½	20	22½	25	27½	30	
26	Thread 60° F.	B. typhosus (O)	Phenol	1:80	+	+	+	...	+	...	2 days at 37° C.
				1:75	+	+	...	+	...	...	
				1:70	...	...	...	...	...	...	
				1:65	...	...	...	...	...	...	
				1:60	...	...	...	...	...	...	
27	Thread 61° F.	B. typhosus (O)	Phenol	1:90	+	+	+	+	+	...	2 days at 37° C.
				1:85	+	+	+	+	+	...	
				1:80	+	+	+	...	...	...	
				1:75	+	+	...	...	...	...	
				1:70	...	...	...	...	...	...	
28	Thread 60° F.	B. typhosus (O)	Liq. cresyl sap. (J.)	1:960	+	+	+	+	+	+	2 days at 37° C.
				1:920	+	+	+	+	+	+	
				1:880	+	+	+	+	+	+	
				1:840	+	+	+	+	+	+	
			Phenol	1:80	+	+	+	+	...	...	
29	Thread 61° F.	B. typhosus (O)	Cyllin	1:1000	+	+	+	+	+	+	2 days at 37° C.
				1:960	+	+	+	+	+	+	
				1:920	+	+	+	+	+	+	
				1:880	+	+	+	+	+	+	
			Phenol	1:80	+	+	...	...	...	...	
30	Thread 62° F.	B. typhosus (O)	Liq. cresyl sap. (J.)	1:320	+	+	+	+	+	+	2 days at 37° C.
				1:280	+	+	+	+	+	+	
				1:240	+	+	+	+	+	+	
				1:200	+	+	+	+	+	+	
			Phenol	1:80	+	+	...	...	...	...	
31	Thread 60° F.	B. typhosus (O)	Liq. cresyl sap. (J.)	1:140	...	...	...	...	...	...	2 days at 37° C.
				1:120	...	...	...	...	...	...	
				1:100	...	...	..	...	...	...	
				1:70	...	...	...	...	...	...	
			Phenol	1:70	+	...	...	...	...	...	
32	Thread 62° F.	B. typhosus (O)	Cyllin	1:735	+	+	+	+	+	+	2 days at 37° C.
				1:700	+	+	+	+	+	+	
				1:665	+	+	+	+	+	+	
				1:630	+	+	+	+	+	+	
			Phenol	1:70	...	...	...	...	...	...	
33	Thread 62° F.	B. typhosus (O)	Cyllin	1:600	+	+	+	+	+	+	2 days at 37° C.
				1:560	+	+	+	+	+	+	
				1:480	+	+	+	+	+	+	
				1:400	+	+	+	+	+	+	
			Phenol	1:80	+	+	...	...	...	...	
34	Thread 63° F.	B. typhosus (O)	Cyllin	1:320	+	+	+	+	+	+	2 days at 37° C.
				1:280	+	+	+	+	+	+	
				1:240	+	+	+	+	+	...	
				1:200	+	+	+	+	+	...	
			Phenol	1:80	+	...	...	...	...	...	
35	Thread 60° F.	B. typhosus (O)	Liq. cresyl sap. (J.)	1:200	+	+	+	+	+	...	2 days at 37° C.
				1:160	+	...	...	...	...	...	
				1:120	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:80	+	+	+	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					17½	20	22½	25	27½	30	
36	Thread 63° F.	B. typhosus (O)	Cyllin	1:200	+	+	+	+	+	+	2 days at 37° C.
				1:160	+	+	+	...	...	...	
				1:130	+	+	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:80	+	+	+	...	...	...	
37	Thread 62° F.	B. typhosus (K)	Cyllin	1:320	+	+	+	+	+	+	2 days at 37° C.
				1:240	+	+	+	+	+	+	
				1:160	+	+	+	...	...	...	
				1:100	+	...	...	...	...	...	
			Phenol	1:80	+	+	...	...	...	...	
38	Thread 64° F.	B. typhosus (O)	Izal	1:350	+	+	+	+	+	+	2 days at 37° C.
				1:280	+	+	+	+	+	+	
				1:210	+	+	+	+	+	+	
				1:140	+	+	+	+	+	+	
			Phenol	1:70	+	+	...	...	...	...	
39	Thread 63° F.	B. typhosus (O)	Liq. cresyl sap.	1:200	+	+	+	+	...	...	2 days at 37° C.
				1:150	+	+	+	...	...	...	
				1:100	...	...	...	...	...	...	
			San. (B.)	1:70	...	...	...	...	...	...	
			Phenol	1:70	+	...	...	...	...	...	
40	Thread 62° F.	B. typhosus (K)	Izal	1:200	+	+	+	+	+	+	2 days at 37° C.
				1:160	+	+	+	+	+	+	
				1:130	+	+	+	...	+	...	
				1:100	+	+	...	...	...	...	
			Phenol	1:70	+	+	...	...	...	...	
41	Thread 62° F.	B. typhosus (McF.)	Izal	1:250	+	+	+	+	+	+	2 days at 37° C.
				1:200	+	+	+	+	+	+	
				1:150	+	+	+	+	+	+	
				1:100	+	+	+	+	+	...	
			Phenol	1:90	+	+	+	+	...	...	
42	Thread 64° F.	B. typhosus (McF.)	Tr. Iodi	1:500	+	+	+	+	+	+	2 days at 37° C.
				1:400	+	+	+	+	+	+	
				1:300	+	+	+	+	+	+	
				1:200	+	+	+	+	+	+	
			Phenol	1:90	+	...	...	...	...	...	
43	Thread 64° F.	B. typhosus (McF.)	Tr. Iodi	1:200	+	+	+	+	+	+	2 days at 37° C
				1:150	+	+	+	+	+	+	
				1:100	+	+	+	+	+	+	
				1:70	+	+	...	...	...	...	
			Phenol	1:100	+	+	...	...	...	...	
44	Thread 63° F.	B. prodigiosus	Phenol	1:55	+	+	...	...	...	...	4 days at 22° C.
				1:50	+	...	...	...	...	...	
				1:45	...	...	...	...	...	...	
				1:40	...	...	...	...	...	...	
				1:35	...	...	...	...	...	...	
45	Thread 63° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:600	+	+	+	+	+	+	4 days at 22° C.
				1:575	+	+	+	+	+	+	
				1:550	+	+	+	+	+	+	
				1:525	+	+	+	+	+	+	
			Phenol	1:50	+	+	+	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					17½	20	22½	25	27½	30	
46	Thread 62° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:200	+	+	+	+	+	+	4 days at 22° C.
				1:175	+	+	+	+	+	+	
				1:150	+	+	+	+	+	...	
				1:125	+	+	+	...	...	...	
			Phenol	1:50	...	...	...	...	...	...	
47	Thread 60° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:125	+	+	+	+	+	+	4 days at 22° C.
				1:100	...	...	...	...	...	...	
				1:75	...	...	...	...	...	...	
				1:50	...	...	...	...	...	...	
			Phenol	1:50	...	...	...	...	...	...	
48	Thread 64° F.	B. prodigiosus	Cyllin	1:500	+	+	+	+	+	+	4 days at 22° C.
				1:450	+	+	+	+	+	+	
				1:400	+	+	+	+	+	+	
				1:350	+	+	+	+	+	+	
			Phenol	1:50	...	...	...	...	...	...	
49	Thread 62° F.	B. prodigiosus	Cyllin	1:300	+	+	+	+	+	+	4 days at 22° C.
				1:270	+	+	+	+	+	+	
				1:240	+	+	+	+	+	+	
				1:200	+	+	+	+	+	+	
			Phenol	1:60	...	...	...	...	...	...	
50	Thread 65° F.	B. prodigiosus	Cyllin	1:175	+	+	+	+	+	+	4 days at 2[illegible]° C.
				1:140	+	+	+	+	+	...	
				1:105	+	+	+	...	...	...	
				1:70	+	+	...	...	...	...	
			Phenol	1:70	+	+	+	...	...	...	
51	Thread 60° F.	B. prodigiosus	Cyllin	1:160	+	+	+	+	...	...	4 days at 22° C.
				1:130	+	+	+	...	...	...	
				1:100	...	...	...	...	...	...	
				1:70	...	...	...	...	...	...	
			Phenol	1:70	+	+	+	...	...	...	
52	Thread 60° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:175	+	+	+	+	...	...	4 days at 22° C.
				1:140	+	...	...	...	...	...	
				1:105	...	...	...	...	...	...	
				1:70	...	...	...	...	...	...	
			Phenol	1:70	+	+	...	...	...	...	
53	Thread 63° F.	B. prodigiosus	Izal	1:250	+	+	+	+	+	+	4 days at 22° C.
				1:200	+	+	+	+	+	+	
				1:150	+	+	+	+	+	+	
				1:100	+	+	+	+	+	+	
			Phenol	1:70	+	...	...	...	...	...	
54	Thread 62° F.	B. prodigiosus	Liq. cresyl sap. (San. A)	1:200	+	+	+	+	+	+	4 days at 22° C.
				1:150	+	+	+	+	+	+	
				1:100	+	+	...	...	...	...	
				1:70	...	...	...	...	...	...	
			Phenol	1:70	+	+	...	...	...	...	
55	Thread 65° F.	B. prodigiosus	Lysol	1:200	+	+	+	+	+	+	4 days at 22° C.
				1:150	+	+	+	+	+	+	
				1:100	+	+	+	...	..	...	
				1:70	+	...	...	...	...	...	
			Phenol	1:70	+	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					17½	20	22½	25	27½	30	
56	Thread 61° F.	B. prodigiosus	Tr. iodi	1:500	+	+	+	+	+	+	4 days at 22° C.
				1:400	+	+	+	+	+	+	
				1:300	+	+	+	+	+	+	
				1:200	+	+	+	+	+	+	
			Phenol	1:80	...	...	...	...	...	...	
57	Thread 60° F.	B. prodigiosus	$HgCl_2$	1:100000	+	+	+	+	+	+	4 days at 22° C.
				1:80000	+	+	+	+	+	+	
				1:60000	+	+	+	+	+	+	
				1:50000	+	+	+	+	+	+	
			Phenol	1:90	+	+	+	...	...	...	
58	Thread 62° F.	B. prodigiosus	$HgCl_2$	1:40000	+	+	+	...	...	...	4 days at 22° C.
				1:30000	...	...	...	...	...	...	
				1:20000	...	...	...	...	...	...	
				1:10000	...	...	...	...	...	...	
			Phenol	1:90	+	+	...	...	...	...	
59	Thread 61° F.	V. choleræ	Cyllin	1:4000	+	+	+	...	+	...	2 days at 37° C.
				1:3500	+	+	...	...	+	+	
				1:3000	+	+	+	...	+	...	
				1:2500	+	+	+	+	...	...	
			Phenol	1:100	...	...	...	...	...	...	
60	Thread 60° F.	V. choleræ	Cyllin	1:3000	+	+	...	+	+	...	2 days at 37° C.
				1:2500	+	...	+	...	...	...	
				1:2000	...	+	...	...	...	...	
				1:1500	...	+	...	...	...	...	
			Phenol	1:150	+	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					2½	5	7½	10	12½	15	
61	Drop	Anthrax,	$HgCl_2$	1:80	...	...	...	...	...	...	10 days
	64° F.	sporo-		1:70	...	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:60	...	...	...	...	...	...	
	used			1:50	...	...	...	...	...	...	
				1:40	...	...	...	...	...	...	
62	Drop	Anthrax,	$HgCl_2$	1:80	...	...	...	...	...	...	10 days
	62° F.	sporo-		1:70	...	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:60		...	...	...	...	...	
	used			1:50	...		...	...	...	...	
				1:40	...	.	...	...	...	...	
63	Drop	Anthrax,	$HgCl_2$	1:80	...	...	...	...	...	...	10 days
	64° F.	sporo-		1:70	...	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:60	...	...	...	...	...	...	
	used			1:50	+	...	...	...	...	...	
				1:40	+	...	...	...	...	...	
64	Drop	Anthrax,	$HgCl_2$	1:130	...	...	...	...	...	...	10 days
	62° F.	sporo-		1:120	...	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:110	...	...	+	...	...	...	
	used			1:100	...	+	...	...	...	...	
				1:90	...	+	...	...	...	...	
65	Drop	Anthrax,	$HgCl_2$	1:180	...	...	+	+	...	...	10 days
	65° F.	sporo-		1:170	...	...	...	...	+	...	at 37° C.
	NH_4HS	genes		1:160	...	...	...	...	...	...	
	used			1:150	...	...	...	...	...	...	
				1:140	...	...	...	...	...	...	
66	Drop	Anthrax,	$HgCl_2$	1:330	...	...	...	...	...	...	7 days
	62° F.	sporo-		1:300	...	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:260	...	...	...	...	+	...	
	used			1:230	...	...	...	+	...	...	
				1:200	...	...	...	...	...	...	
67	Drop	Anthrax,	$HgCl_2$	1:200	...	+	...	...	...	...	7 days
	64° F.	sporo-		1:150	...	...	...	+	...	...	at 37° C.
	NH_4HS	genes		1:100	+	...	...	...	...	...	
	used			1:75	...	...	...	...	...	...	
				1:50	...	...	...	...	...	...	
68	Drop	Anthrax,	$HgCl_2$	1:300	...	...	+	...	...	...	7 days
	65° F.	sporo-		1:250	...	+	...	...	...	...	at 37° C.
	NH_4HS	genes		1:200	+	...	...	...	...	...	
	used			1:150	...	+	...	...	...	...	
				1:100	...	...	...	...	...	...	
69	Drop	Anthrax,	$HgCl_2$	1:125	+	...	+	+	...	...	7 days
	65° F.	sporo-		1:100	+	...	...	...	...	...	at 37° C.
	NH_4HS	genes		1:75	+	...	...	...	...	...	
	used			1:50	...	...	...	...	...	...	
			Phenol	1:5	+	+	+	+	+	+	
70	Drop	Anthrax,	$HgCl_2$	1:125	...	...	...	...	+	...	7 days
	64° F.	sporo-		1:100	...	+	...	...	...	...	at 37° C.
	NH_4HS	genes		1:75	...	...	...	...	...	...	
	used.			1:50	...	...	+	...	...	...	
			Phenol	1:5	+	+	+	+	+	+	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					2½	5	7½	10	12½	15	
71	Drop	Anthrax,	$HgCl_2$	1:600	+	+	...	...	...	...	7 days
	63° F.	sporo-		1:500	...	+	...	...	...	...	at 37° C.
	No	genes.		1:400	...	...	...	+	...	...	
	NH_4HS			1:300	...	...	...	...	...	...	
			Phenol	1:5	+	+	+	+	+	+	
72	Drop	Anthrax,	$HgCl_2$	1:550	...	...	...	...	...	...	7 days
	61° F.	sporo-		1:500	+	...	...	...	...	...	at 37° C.
	No	genes.		1:450	...	...	...	...	...	...	
	NH_4HS			1:400	...	...	...	...	...	...	
			Phenol	1:5	+	+	+	+	+	+	
73	Drop	Anthrax,	$HgCl_2$	1:900	+	+	+	+	+	+	7 days
	63° F.	sporo-		1:800	+	+	+	+	+	...	at 37° C.
	No	genes.		1:700	+	+	+	+	...	...	
	NH_4HS			1:600	+	+	...	+	+	...	
			Phenol	1:5	+	+	+	+	+	+	
74	Drop	B. typho-	$HgCl_2$	1:40000	...	...	...	...	...	...	2 days
	64° F.	sus		1:35000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:30000	...	...	...	...	...	...	
	NH_4HS			1:25000	...	...	...	...	...	...	
	used.		Phenol	1:110	+	+	...	...	...	...	
75	Drop	B. typho-	$HgCl_2$	1:80000	...	...	...	...	...	...	2 days
	63° F.	sus		1:70000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:60000	...	...	...	...	...	...	
	NH_4HS			1:50000	...	...	...	...	...	...	
	used.		Phenol	1:120	+	+	+	...	...	...	
76	Drop	B. typho-	$HgCl_2$	1:120000	...	...	...	...	...	...	2 days
	65° F.	sus		1:110000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:100000	...	...	...	...	...	...	
	NH_4HS			1:90000	...	...	...	...	...	...	
	used.		Phenol	1:120	+	+	...	...	...	...	
77	Drop	B. typho-	$HgCl_2$	1:160000	...	...	...	...	...	...	2 days
	64° F.	sus		1:150000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:140000	...	...	...	...	...	...	
	NH_4HS			1:130000	...	...	...	...	...	..	
	used.		Phenol	1:120	+	+	...	...	...	...	
78	Drop	B. typho-	$HgCl_2$	1:300000	...	...	...	...	...	...	2 days
	61° F.	sus		1:250000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:200000	...	...	...	...	...	...	
	NH_4HS			1:180000	...	...	...	...	...	...	
	used.		Phenol	1:120	+	...	...	...	...	...	
79	Drop	B. typho-	$HgCl_2$	1:500000	...	...	...	...	...	...	2 days
	61° F.	sus		1:450000	...	...	...	...	...	...	at 37° C.
	No	(McF.)		1:400000	+	+	...	...	...	...	
	NH_4HS			1:350000	+	+	...	...	...	...	
	used.		Phenol	1:120	+	...	...	...	...	...	
80	Drop	B. prodi-		1:90	+	...	...	...	...	...	4 days
	62° F.	giosus	Phenol	1:80	+	...	...	...	...	...	at 22° C.
				1:70	...	...	...	...	...	...	
				1:60	...	...	...	...	...	...	
				1:50	...	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					2½	5	7½	10	12½	15	
81	Drop 63° F.	B. prodigiosus	Phenol	1:120	+	+	+	+	+	...	4 days at 22° C.
				1:110	+	+	+	+	...	+	
				1:100	+	+	+	...	...	...	
				1:90	+	...	...	...	...	...	
				1:80	+	+	...	...	...	...	
82	Drop 65° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:400	+	+	+	+	+	+	4 days at 22° C.
				1:350	+	+	+	+	...	...	
				1:300	+	+	...	...	...	...	
				1:250	+	...	+	...	...	...	
			Phenol	1:100	+	+	+	+	...	...	
83	Drop 65° F.	B. prodigiosus	Cyllin	1:1000	+	+	+	+	+	+	4 days at 22° C.
				1:950	+	+	+	+	+	+	
				1:900	+	+	+	+	+	+	
				1:850	+	+	+	+	...	...	
			Phenol	1:100	+	+	+	+	+	...	
84	Drop 60° F.	B. prodigiosus	Cyllin	1:900	+	+	+	+	+	+	4 days at 22° C.
				1:850	+	+	+	...	...	...	
				1:825	+	+	...	...	...	...	
				1:800	...	...	...	...	...	...	
			Phenol	1:90	+	...	...	...	...	...	
85	Drop 61° F.	B. prodigiosus	Liq. cresyl sap. (J.)	1:350	+	+	+	+	+	+	4 days at 22° C.
				1:300	+	+	+	+	+	+	
				1:250	+	+	+	...	...	...	
				1:200	+	+	+	...	...	...	
			Phenol	1:100	+	+	+	+	+	...	
86	Drop 63° F.	B. prodigiosus	Izal	1:600	+	+	+	+	...	...	4 days at 22° C.
				1:500	+	+	...	...	...	...	
				1:400	...	...	...	...	...	...	
				1:300	...	...	...	...	...	...	
			Phenol	1:100	+	+	+	...	...	...	
87	Drop 70° F.	B. prodigiosus	Izal	1:650	+	+	...	...	...	...	4 days at 22° C.
				1:600	+	+	...	...	...	...	
				1:550	+	...	...	...	...	...	
				1:500	...	...	...	...	...	...	
			Phenol	1:100	+	...	...	...	...	...	
88	Drop 62° F.	B. prodigiosus	Liq. cresyl sap. (San. B.)	1:500	+	+	...	...	...	...	4 days at 22° C.
				1:450	+	...	...	...	...	...	
				1:400	+	...	...	...	...	...	
				1:350	+	...	...	...	...	...	
			Phenol	1:100	+	+	+	...	...	...	
89	Drop 66° F.	B. prodigiosus	Liq. cresyl sap. (San. A.)	1:400	+	+	+	+	+	+	4 days at 22° C.
				1:350	+	+	+	+	+	+	
				1:300	+	+	+	+	+	...	
				1:250	+	+	+	...	...	...	
			Phenol	1:100	+	+	...	...	...	...	
90	Drop 69° F.	B. prodigiosus	Lysol	1:250	+	+	+	...	...	...	4 days at 22° C.
				1:200	+	...	...	...	...	...	
				1:150	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:100	+	...	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
91	Drop 65° F.	B. prodigiosus	Chinosol	1:100	+	+	+	+	+	+	4 days at 22° C.
				1:50	+	+	+	+	+	+	
				1:30	+	+	+	+	+	+	
				1:20	+	+	...	...	...	...	
			Phenol	1:100	+	+	...	...	...	...	
92	Drop 70° F.	B. prodigiosus	Lysol, the diluting water containing 1/5 part of sterile urine	1:300	+	+	+	+	+	+	4 days at 22° C.
				1:200	+	...	...	...	...	...	
				1:200	...	...	...	...	...	...	
				1:50	...	...	...	...	...	...	
			Phenol	1:100	+	...	...	...	...	...	
93	Drop 69° F.	B. prodigiosus	Listerine	1:15	+	+	+	+	+	+	4 days at 22° C.
				1:10	+	+	+	+	+	+	
				1:5	+	+	+	+	+	+	
				1:3	+	...	...	...	...	...	
			Phenol	1:100	+	...	...	...	...	...	
94	Drop 66° F.	B. prodigiosus	Tr. Iodi.	1:2500	+	+	+	+	+	+	4 days at 22° C.
				1:2000	+	+	+	+	+	+	
				1:1700	+	...	...	...	...	...	
				1:1500	...	...	...	...	...	...	
			Phenol	1:100	+	+	...	...	...	...	
95	Drop 68° F.	B. prodigiosus	Permanganate of potassium	1:5000	+	+	+	+	+	+	4 days at 22° C.
				1:4000	+	+	+	+	+	+	
				1:3000	+	+	+	+	+	+	
				1:2000	+	+	...	...	...	...	
			Phenol	1:100	+	+	...	...	...	...	
96	Drop 63° F.	B. typhosus (O.)	Phenol	1:100	+	+	+	+	+	+	2 days at 37° C.
				1:90	+	+	+	+	...	...	
				1:80	+	...	...	...	...	...	
				1:70	...	...	...	...	...	...	
				1:60	...	...	...	...	...	...	
97	Drop	B. typhosus (K.)	Phenol	1:100	+	+	+	+	+	+	2 days at 37° C.
				1:90	+	+	+	...	...	...	
				1:80	+	...	...	...	...	...	
				1:70	..	...	...	...	...	...	
				1:60	...	...	...	...	...	...	
98	Drop 60° F.	B. typhosus (K.)	Liq. cresyl sap. (H.W.)	1:500	+	+	+	+	+	+	2 days at 37° C.
				1:400	+	+	+	+	+	+	
				1:350	+	+	+	+	+	+	
				1:250	+	+	+	+	...	...	
			Phenol	1:90	+	+	+	+	...	...	
99	Drop 62° F.	B. typhosus (K.)	Liq. cresyl sap. (B.T.)	1:300	+	+	+	+	+	+	2 days at 37° C.
				1:250	+	+	+	+	...	...	
				1:200	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	...	...	...	
100	Drop 63° F.	B. typhosus (K.)	Liq. cresyl sap. (T.M.)	1:300	+	+	+	+	+	+	2 days at 37° C.
				1:250	+	+	+	+	+	+	
				1:200	+	+	+	+	+	...	
				1:100	+	+	+	...	...	...	
			Phenol	1:100	+	+	+	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
101	Drop 62° F.	B. typhosus (K.)	Liq. cresyl sap. (B.B.)	1:300	+	+	+	+	...	...	2 days at 37° C.
				1:250	+	+	..	...	...	...	
				1:200	+	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:100	+	+	+	...	..	...	
102	Drop 61° F.	B. typhosus (K.)	Liq. cresyl sap (B.)	1:190	+	+	+	+	+	+	2 days at 37° C.
				1:180	+	+	+	+	+	+	
				1:170	+	+	+	+	+	+	
				1:160	+	+	+	...	...	...	
			Phenol	1:100	+	+	+	...	...	...	
103	Drop 60° F.	B. typhosus (K.)	Liq. cresyl sap (H.)	1:300	+	+	+	+	+	...	2 days at 37° C.
				1:250	+	+	...	...	...	...	
				1:200	+	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:100	+	+	+	+	+	...	
104	Drop 59° F.	B. typhosus (K.)	Liq. cresyl sap. (W.O.)	1:275	+	+	+	+	+	+	2 days at 37° C.
				1:250	+	+	+	+	+	...	
				1:225	+	+	+	...	...	...	
				1:200	+	+	...	...	...	...	
			Phenol	1:80	+	+	+	...	...	...	
105	Drop 64° F.	B. typhosus (O.)	Nobe's Fluid	1:50	+	+	+	+	+	+	2 days at 37° C.
				1:40	+	+	+	+	+	+	
				1:30	+	+	+	+	+	+	
				1:20	+	+	+	+	...	...	
			Phenol	1:120	+	+	+	+	...	...	
106	Drop 64° F.	B. typhosus (O.)	Pino-phenol	1:700	+	+	+	+	+	+	2 days at 37° C.
				1:600	+	+	+	+	+	+	
				1:500	+	+	+	+	+	+	
				1:400	+	+	+	+	...	...	
			Phenol	1:80	...	...	...	...	...	...	
107	Drop 61° F.	B. typhosus (O.)	Pino-phenol	1:230	+	+	+	+	+	+	2 days at 37° C.
				1:220	+	+	+	+	...	...	
				1:210	+	+	+	...	...	...	
				1:200	+	+	...	...	...	...	
			Phenol	1:80	+	+	...	...	...	...	
108	Drop 61° F.	B. typhosus (K.)	Liq. cresyl sap. (J.)	1:1000	+	+	+	+	+	+	2 days at 37° C.
				1:950	+	+	+	+	+	+	
				1:900	+	+	+	+	+	+	
				1:850	+	+	+	+	+	...	
			Phenol	1:90	+	+	...	...	...	...	
109	Drop 62° F.	B. typhosus (O.)	Liq. cresyl sap. (J.S.)	1:950	+	+	+	+	+	+	2 days at 37° C.
				1:900	+	+	+	+	+	+	
				1:850	+	+	+	+	...	...	
				1:800	+	...	...	...	...	...	
			Phenol	1:90	+	...	...	...	...	...	
110	Drop 66° F.	B. typhosus (O.)	Liq. cresyl sap. (J.S.)	1:1250	+	+	+	+	+	+	2 days at 37° C.
				1:1150	+	+	+	+	+	+	
				1:1000	+	+	+	+	+	...	
				1:800	+	+	+	...	...	...	
			Phenol	1:100	+	+	+	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation
111	Drop 64° F.	B. typhosus (K.)	Liq.	1 : 1250	+	+	+	+	+	...	2 days at 37° C.
			cresyl	1 : 1200	+	...	...	+	...	...	
			sap.	1 : 1150	...	...	...	...	...	...	
			(J.)	1 : 1100	+	...	...	...	...	...	
			Phenol	1 : 100	...	...	...	...	...	...	
112	Drop 61° F.	B. typhosus (O.)	Liq.	1 : 455	+	+	+	+	+	+	2 days at 37° C.
			cresyl	1 : 450	+	+	+	...	+	...	
			sap.	1 : 405	+	+	+	+	...	...	
			(S.A.)	1 : 360	+	+	+	...	...	...	
			Phenol	1 : 90	+	...	...	...	...	...	
113	Drop 66° F.	B. typhosus (O.)	Liq.	1 : 450	+	+	+	+	+	...	2 days at 37° C.
			cresyl	1 : 400	+	+	+	...	...	...	
			sap.	1 : 350	+	+	+	...	...	...	
			(S.B.)	1 : 300	+	...	+	...	...	...	
			Phenol	1 : 100	+	+	...	...	...	...	
114	Drop 64° F.	B. typhosus (O.)	Liq.	1 : 550	+	+	+	+	+	+	2 days at 37° C.
			cresyl	1 : 500	+	+	+	+	+	+	
			sap.	1 : 450	+	+	+	...	...	...	
			(S.B.)	1 : 400	+	+	...	...	...	...	
			Phenol	1 : 100	+	+	+	...	...	...	
115	Drop 62° F.	B. typhosus (O.)	Liq.	1 : 450	+	+	+	+	+	+	2 days at 37° C.
			cresyl	1 : 400	+	+	+	+	+	...	
			sap.	1 : 350	+	+	...	...	...	...	
			(S.A.)	1 : 300	+	+	+	...	...	+	
			Phenol	1 : 100	+	+	+	+	+	...	
116	Drop 62° F.	B. typhosus (O.)	Cyllin	1 : 1050	+	+	+	+	+	+	2 days at 37° C.
				1 : 1000	+	+	+	+	+	+	
				1 : 950	+	+	+	+	+	+	
				1 : 900	+	+	+	+	+	...	
			Phenol	1 : 100	+	+	+	+	...	...	
117	Drop 64° F.	B. typhosus (O.)	Izal	1 : 600	+	+	+	...	...	...	2 days at 37° C.
				1 : 550	+	...	...	...	...	...	
				1 : 500	...	...	...	...	...	...	
				1 : 450	...	...	...	...	...	...	
			Phenol	1 : 100	+	+	+	...	...	...	
118	Drop 65° F.	B. typhosus (K.)	Izal	1 : 650	+	+	+	+	+	+	2 days at 37° C.
				1 : 600	+	+	+	+	+	...	
				1 : 550	+	+	+	...	...	...	
				1 : 500	+	...	...	...	...	...	
			Phenol	1 : 90	+	...	...	...	...	...	
119	Drop 66° F.	B. typhosus (McF.)	Cyllin	1 : 1210	+	+	+	+	+	+	2 days at 37° C.
				1 : 1100	+	+	+	+	+	+	
				1 : 990	+	+	...	...	...	...	
				: 880	+	...	...	...	...	...	
			Phenol	1 : 110	+	+	+	...	...	...	
120	Drop 66° F.	B. typhosus (McF.)	Cyllin	1 : 1200	+	+	+	+	+	+	2 days at 37° C.
				1 : 1100	+	+	+	+	+	+	
				1 : 1000	+	+	+	+	+	+	
				1 : 900	+	+	+	...	...	...	
			Phenol	1 : 120	+	+	+	+	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
121	Drop 68° F.	B. typhosus (McF.)	Permanganate of potassium	1:400	...	...	...	...	...	...	2 days at 37° C.
				1:300	...	...	...	...	...	...	
				1:200	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:120	+	+	+	...	...	...	
122	Drop 63° F.	B. typhosus (McF.)	Permanganate of potassium	1:2000	...	...	...	...	...	...	2 days at 37° C.
				1:1500	...	...	...	...	...	...	
				1:1000	...	...	...	...	...	...	
				1:800	...	...	...	...	...	...	
			Phenol	1:120	+	+	+	+	+	...	
123	Drop 68° F.	B. typhosus (McF.)	Permanganate of potassium	1:10000	+	+	+	+	+	...	2 days at 37° C.
				1:9000	+	+	+	+	+	...	
				1:7000	+	+	+	+	...	...	
				1:5000	+	+	...	...	...	...	
			Phenol	1:120	+	+	...	...	...	...	
124	Drop 65° F.	B. typhosus (McF.)	Permanganate of potassium dilutions made with 1/5 part of sterile urine	1:3000	+	+	+	+	+	+	2 days at 37° C.
				1:2000	+	+	+	...	...	...	
				1:1000	+	...	...	...	...	...	
				1:500	+	...	...	...	...	...	
			Phenol	1:120	+	+	+	+	...	...	
125	Drop 61° F.	B. typhosus (McF.)	Sanitas Co.'s. Liq. cresyl sap. (A.)	1:250	+	+	...	...	...	...	2 days at 37° C.
				1:180	+	...	...	...	...	...	
				1:130	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:90	+	...	...	...	...	...	
126	Drop 67° F.	B. typhosus (McF.)	Cyllin dilutions containing 1/5 part sterile urine	1:990	+	+	+	+	+	+	2 days at 37° C.
				1:880	+	+	+	+	+	+	
				1:770	+	...	...	...	...	...	
				1:660	...	...	...	...	...	...	
			Phenol	1:110	+	...	...	...	...	...	
127	Drop 62° F.	B. typhosus (McF.)	Tr. Iodi. dilutions containing 1/5 part sterile urine	1:500	+	+	+	+	+	+	2 days at 37° C.
				1:400	+	+	+	+	+	+	
				1:300	+	+	+	+	+	+	
				1:200	+	+	+	+	+	+	
			Phenol	1:110	+	+	+	...	...	...	
128	Drop 65° F.	B. typhosus (McF.)	Tr. Iodi. dilutions containing 1/5 part sterile urine	1:200	+	...	...	...	...	...	2 days at 37° C.
				1:150	...	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
				1:50	...	...	...	...	...	...	
			Phenol	1:110	+	+	...	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes.						Period and Temperature of Incubation.
					2½	5	7½	10	12½	15	
129	Drop 66° F.	V. choleræ	Cyllin	1:5000	+	+	+	+	+	...	2 days at 37° C.
				1:4500	+	+	+	+	+	...	
				1:4000	+	+	+	...	...	...	
				1:3500	+	...	...	...	...	...	
			Phenol	1:200	+	+	+	+	...	...	
130	Drop 63° F.	B. typhosus (McF.)	Cyllin	1:1430	+	+	+	+	+	+	2 days at 37° C.
				1:1210	+	+	+	+	+	...	
				1:990	+	+	..	...	...	...	
				1:770	...	...	...	...	...	...	
			Phenol	1:110	+	+	+	+	...	...	
131	Drop 62° F.	B. typhosus (McF.)	Cyllin	1:1420	+	+	+	+	...	...	2 days at 37° C.
				1:1210	+	+	...	...	...	...	
				1:990	...	...	...	...	...	...	
				1:770	...	...	...	...	...	...	
			Phenol	1:110	+	...	...	...	...	...	
132	Drop 66° F.	B. typhosus (McF.)	Cyllin	1:1210	+	+	+	+	+	+	2 days at 37° C.
				1:1100	+	+	+	+	+	+	
				1:990	+	+	...	...	...	...	
				1:880	+	...	...	...	...	...	
			Phenol	1:110	+	+	+	+	+	+	
133	Drop 65° F.	B. typhosus (McF.)	Cyllin	1:1210	+	+	+	+	...	...	2 days at 37° C.
				1:1100	+	+	...	...	...	...	
				1:990	+	...	...	...	...	...	
				1:880	+	...	...	...	...	...	
			Phenol	1:110	+	...	...	...	...	...	
134	Drop 70° F.	B. typhosus (W.)	Cyllin	1:1430	+	+	+	+	+	...	2 days at 37° C.
				1:1300	+	+	...	...	...	...	
				1:1170	+	...	...	...	...	...	
				1:1040	...	...	...	...	...	...	
			Phenol	1:130	...	...	...	...	...	...	
135	Drop 70° F.	B. typhosus (W.)	Cyllin	1:1430	+	+	+	+	...	...	2 days at 37° C.
				1:1300	+	+	+	...	...	...	
				1:1170	+	+	...	...	...	...	
				1:1040	+	...	...	...	...	...	
			Phenol	1:130	+	...	...	...	...	...	
136	Drop 62° F.	B. typhosus (McF.)	Cyllin	1:1300	+	+	+	+	+	+	2 days at 37° C.
				1:1100	+	+	+	...	...	...	
				1:900	+	+	...	...	...	...	
				1:700	+	...	...	...	...	...	
			Phenol	1:100	+	+	+	+	+	+	
137	Drop 65° F.	B. typhosus (McF.)	Cyllin	1:780	+	+	+	+	+	+	2 days at 37° C.
				1:720	+	+	+	+	+	+	
				1:660	+	+	+	+	+	...	
				1:600	+	+	+	+	+	...	
			Phenol	1:100	+	+	+	...	...	...	
138	Drop 63° F.	B. typhosus (McF.)	Kerol	1:1100	+	+	+	+	+	+	2 days at 37° C.
				1:990	+	+	+	+	+	+	
				1:880	+	+	+	+	...	...	
				1:770	+	+	+	...	...	...	
			Phenol	1:110	+	+	+	+	+	..	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
139	Drop 63° F.	B. typhosus (McF.)	Izal	1:1100	+	+	+	+	+	+	2 days at 37° C.
				1:990	+	+	+	+	...	...	
				1:880	+	+	+	...	...	...	
				1:770	+	+	...	...	...	...	
			Phenol	1:110	+	+	+	+	+	+	
140	Drop 64° F.	B. typhosus (McF.)	Izal	1:1100	+	+	+	+	...	...	2 days[1] at 37° C.
				1:990	+	+	+	...	...	...	
				1:880	+	+	+	...	...	...	
				1:770	...	...	...	...	...	...	
			Phenol	1:110	+	+	+	+	+	...	
141	Drop 67° F.	Fæces and urine	$HgCl_2$ 2 grammes HCl 4 cc.	1:10000	+	+	+	+	+	+	24 hours at 37° C.
				1:6000	+	+	+	+	+	+	
				1:4000	+	+	+	+	+	+	
				1:2000	+	+	+	+	+	...	
			Phenol	1:90	+	...	...	...	...	...	
142	Drop 66° F.	Fæces and urine	$HgCl_2$ 2 grammes HCl 4 cc.	1:4000	+	+	+	+	+	+	24 hours at 37° C.
				1:3000	+	+	+	+	+	+	
				1:2000	+	+	+	+	+	+	
				1:1000	+	+	+	+	...	...	
			Phenol	1:90	+	+	...	...	...	...	
143	Drop 64° F.	Fæces and urine	$HgCl_2$ 2 grammes HCl 4 cc.	1:800	...	...	...	...	...	...	24 hours at 37° C.
				1:600	...	...	...	...	...	...	
				1:400	...	...	...	...	...	...	
				1:200	...	...	...	...	...	...	
			Phenol	1:90	+	...	...	...	...	...	
144	Drop 65° F.	Fæces and urine	$HgCl_2$ 2 grammes HCl 4 cc.	1:1050	+	+	+	+	+	+	24 hours at 37° C.
				1:950	+	+	+	+	...	...	
				1:850	+	+	+	...	...	...	
				1:750	+	...	...	...	...	...	
			Phenol	1:95	+	+	+	...	...	...	
145	Drop 65° F.	Fæces and urine	HCl	1:300	+	+	+	+	+	+	24 hours at 37° C.
				1:200	+	+	+	+	+	+	
				1:150	+	+	+	+	...	...	
				1:100	+	...	...	...	...	...	
			Phenol	1:95	+	+	+	+	...	...	
146	Drop 68° F.	Fæces and urine	$HgCl_2$	1:800	+	+	+	+	+	+	24 hours at 37° C.
				1:600	+	+	+	+	+	+	
				1:400	+	+	+	+	+	+	
				1:200	+	+	+	...	...	...	
			Phenol	1:90	+	+	...	...	...	...	
147	Drop 65° F.	Fæces and urine	$HgCl_2$	1:300	+	+	+	+	+	+	24 hours at 37° C.
				1:200	+	+	+	...	...	...	
				1:150	+	...	...	...	...	...	
				1:100	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	+	...	...	
148	Drop 65° F.	Fæces and urine	Formalin	1:135	+	+	+	+	+	+	24 hours at 37° C.
				1:100	+	+	+	+	+	+	
				1:70	+	+	+	...	...	...	
				1:50	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	...	...	...	

No. of Expt.	Method and Temperature at which performed.	Micro-organisms.	Disinfectant.	Dilution.	Lengths of Exposure or Contact in minutes. 2½	5	7½	10	12½	15	Period and Temperature of Incubation.
149	Drop 64° F.	Fæces and Urine	$KMnO_4$	1:700	+	+	+	+	+	+	24 hours at 37° C.
				1:650	+	+	+	+	+	...	
				1:600	+	+	+	...	...	...	
				1:550	+	...	...	...	...	...	
			Phenol	1:90	+	+	+	+	...	...	
150	Drop 68° F.	Fæces and Urine	Tr. Iodi.	1:225	+	+	+	+	+	+	24 hours at 37° C.
				1:180	+	+	+	+	+	+	
				1:135	+	+	+	+	+	+	
				1:90	+	+	+	+	+	+	
			Phenol	1:90	+	+	...	...	...	...	
151	Drop 67° F.	Fæces and Urine	Lysol	1:375	+	+	+	+	+	+	24 hours at 37° C.
				1:300	+	+	+	+	+	+	
				1:225	+	+	+	+	...	...	
				1:200	+	+	...	...	...	...	
			Phenol	1:90	+	+	+	...	...	...	
152	Drop 69° F.	Fæces and Urine	Cyllin	1:910	+	+	+	+	+	+	24 hours at 37° C.
				1:840	+	+	+	...	...	...	
				1:770	+	...	...	...	...	...	
				1:700	...	...	...	...	...	...	
			Phenol	1:90	+	...	...	...	...	...	
153	Drop 65° F.	Fæces and Urine	Kerol	1:810	+	+	+	+	+	+	24 hours at 37° C.
				1:720	+	+	+	+	+	...	
				1:630	+	+	...	...	...	...	
				1:540	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	+	...	...	
154	Drop 65° F.	Fæces and Urine	Izal	1:540	+	+	+	+	+	+	24 hours at 37° C.
				1:450	+	+	+	+	...	...	
				1:360	+	+	...	...	...	...	
				1:270	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	+	...	...	
155	Drop 66° F.	Fæces and Urine	Liq. cresyl sap. (H.W.)	1:350	+	+	+	+	+	+	24 hours at 37° C.
				1:250	+	+	+	+	+	...	
				1:200	+	+	+	...	...	...	
				1:150	...	...	...	...	...	...	
			Phenol	1:90	+	+	+	+	...	...	

CONFERENCE ON SMOKE ABATEMENT.

PRESIDENTIAL ADDRESS

By Sir OLIVER LODGE, D.Sc., LL.D., F.R.S.,

Principal, University of Birmingham.

Delivered December 12th, 1905.

IT is very appropriate that The Royal Sanitary Institute should have joined with the Coal Smoke Abatement Society to summon this conference, held under their joint auspices, for nothing can be more insanitary in the long run than the sun-obscuring atmosphere in which we artificially arrange to live. Those who try to imagine that coal smoke exerts a disinfecting influence are deceiving themselves. The amount of disinfectant fatal to disease-germs would assuredly also be fatal to higher organisms; and, besides, who wants to live in the midst of a plague of disinfectant, diffused through the common atmosphere, any more than in a plague of anything else?

Moreover, coal smoke contains many other products besides coal tar, asphalt, manures and other useful material, it contains sulphurous acid, an ingredient of the most noxious character, which speedily becomes oxidised into oil of vitriol. But all this is well known and commonplace, although it can hardly be repeated too frequently so long as the barbarous combustion of crude coal in a savage and unorganised manner is permitted in the midst of the semi-civilisation we have so far attained.

Assuming that people are awake to the evil, the problem is to find out a remedy. One remedy that has been suggested is the electrification of the air on a large scale, a plan which I have brought within measurable distance of application, and believe to be the appropriate method of dealing with river and sea mists and other temporary obstructions to traffic, and in general of dealing with fogs of a non-avoidable kind. But if it did not need so much capital to try it on a large scale, I would certainly seek to try it as a temporary measure for some parts of London. It ought also to be useful for the deposition of valuable metallic and chemical fumes, the product of manufacturing processes.

But as a permanent method of dealing with town fog caused by imperfect combustion it would be a very expensive method. It is expensive to produce a town fog, and it would be expensive to dissipate it. The double expense ought not to be tolerated. The right way of dealing with a town fog is not to produce it. If it were only country mist it would not be nearly so deleterious: it would be disturbing to traffic, but it would not enter houses nor lungs, consequently it would do no particular harm, and, moreover, it would soon be dissipated. But the fog which contains products of imperfect combustion is in the first place far denser, in the second place far more readily formed, and in the third place much more permanent. No ordinary warmth will evaporate it and it retains its character even in houses and in lungs, where it causes a dirty and damaging acid deposit.

The right plan is not to produce it, that is to say, not to permit imperfect combustion in large cities, but only to permit combustion planned and executed in such a way that no half-burned products shall escape, and likewise to insist that the material burned shall attain a moderate average of purity, the amount of sulphur especially being kept down, since sulphur is even more noxious when thoroughly burned than when half-burned or not burned at all, thus constituting an exceptional case requiring special attention and treatment.

Problem of Combustion.

To take the problem of combustion, therefore, there are three things to be attended to:

1. Purification of the material to be consumed.
2. The proper means of effecting its complete combustion under conditions of easy regulation and avoidance of dust and dirt.
3. The utilisation of the heat due to that combustion without waste.

1. The scientific and satisfactory combustion of crude coal as it is dug out of the pits is an impossibility; it must first be subjected to some chemical treatment. Its solid and its gaseous constituents ought to be separated from one another. The solid constituents in the form of coke, when properly made, are of exceeding value for smelting and manufacturing operations, and it is the solid portions which will contain the ash and dirt.

The processes involving the use of solid fuel should not be carried on in a big city, but should group themselves round a coalfield, so that the cost of carriage may be small.

The gaseous product, on the other hand, readily lends itself to purifi-

cation and chemical treatment, and can then be *easily transmitted to any distance*, and there burned in a scientific and proper manner under easy regulation, being turned on and off as wanted.

Another scientific method of dealing with coal is to turn almost the whole of it into gas, *i.e.*, all except the ash, by a judicious supply of air and steam, and then to utilise the whole of this gaseous product, purified up to a certain point. Gas of this kind, sometimes called water-gas, sometimes producer-gas, sometimes Mond-gas, according to various details of its preparation, can be made very cheaply and plentifully; but its large amount makes purification of it rather more difficult, and moreover it has not the same heating power, bulk for bulk, as coal-gas proper possesses, without so great an admixture of nitrogen. However, all those details are matters for careful consideration. There are advantages and disadvantages in every plan that has been suggested; but there is not one plan for the combustion of gas that does not far eclipse the uncivilised and essentially savage method of heaping a pile of crude coal together and setting a light to it.

Consider what the burning of coal in a city means:

1. The getting of coal in the pit.
2. The raising of it to the surface.
3. The loading of it into railway trucks.
4. The unloading of it on wharves.
5. The shovelling of it into carts or sacks.
6. The carrying of it on men's backs or wheelbarrows and storing it in coal cellars.
7. The shovelling of it into scuttles and carrying about the house.
8. The putting of it by hand on to fires.
9. The distillation of a great part of it up the chimney, and the half-burning of the rest.
10. The raking out and carrying down of the ashes.
11. The carting of them away and dumping them to form the foundation of a future house.

A long and troublesome series of operations even apart from the fouling of the air, which has not been mentioned, but which is the worst condition of all.

Now consider what the supply of gaseous fuel would entail:

1. The getting of the coal as before.
2. The conversion of it into gas, either at the bottom of the pit or near its mouth.

3. The conveying away of the coke and the manure products to where they are wanted.
4. The transmission of gas in great pipes to the distant town, just as water is now transmitted; with such occasional pumping stations as may be necessary, driven by the power of a small portion of the same gas.
5. The underground distribution of all this fuel, and its utilisation by the turning of a tap, in a manner which will insure complete combustion, with no smoke, no ash, no dirt, no trouble and no residual product to carry away, either in carts, or clothes, or lungs.

Against all these conveniences we have to set the influential and constantly-encountered parrot-cry, "We do not like gas fires." The people who say this do not realise that every coal fire is to some extent a gas fire, though a very bad one. When coal is put on, a quantity of it is necessarily turned into gas—impure and badly-made gas, but gas at any rate, which before long catches light and flames, burning with a smoky flame, but burning and giving what is called a coal fire, though it is really a gas fire, the gas being made on the premises, and made badly, and only half burned because mixed with carbonic acid from the red-hot material below. There is some justification, however, for the prejudice, of course; and the justification is that when people speak of gas fires they think of the imperfect arrangements at present in vogue for burning gas at 3s. or 3s. 6d. a thousand; burning very little of it therefore, and burning that imperfectly, sometimes without causing sufficient draught in the chimney to carry away the products of combustion, which therefore enter the room. When the products from a coal fire enter the room people say the chimney smokes, and regard it as intolerable; but when the same thing happens from an imperfect gas fire they are liable to abuse gas fires in general, as if the defects were a necessary condition of their existence. Moreover, some people go so far as to put a gas fire into a chimney which has troubled them by smoking, because, the products being invisible and somewhat less noxious than the coal fire products, they think they may be tolerated; though at the same time the reputation of the gas fire suffers irretrievably.

None of these things would happen if gas were supplied in large quantities, for use all day for cooking and heating purposes at a very low price. Sufficient would then be burned to make the chimney draw properly, and the general use of such arrangements would stimulate invention to the production of appropriate gas fires, such, for instance,

as some of those used in Pittsburgh, where natural gas is, or was, cheaply available, and where no one thought of burning coal.

It would seem to be wise for municipal authorities or others interested in gas to superintend the proper erection of gas fires, and to encourage their use by supplying them cheaply and inspecting them gratis if inefficient.

2. But now what are the conditions of complete combustion? First of all there must be no cold surfaces to interfere with ignition. Gas must be raised to a certain temperature before it will ignite, the simple theory of a flame is that the combustion of each portion has to ignite the next; and it cannot do that if the temperature is lowered beyond a certain point by cool solid conductors introduced into the flame. In many domestic grates there is far too much iron: there ought by rights to be none, nothing but non-conducting material, within reach of the flames, otherwise the portion of the flame in contact with the good conductor is necessarily extinguished, whether visibly extinguished or not, and the material escapes unburned.

Because the products which escape up the chimney are invisible, it does not follow that there has been complete combustion. Many of the products of incomplete combustion are gaseous, and it is just as wasteful to allow chemically combustible material to escape unconsumed as it is to allow heat to escape when it has once been generated by combustion. This fact is, however, often forgotten, and so long as all the heat generated is utilised, it is thought that there can be no waste. On the contrary, there can be very much waste, and in many cases there is. This matter is so important that it must be illustrated by experiment. The avoidance of cold surfaces in open fire-places and stoves is not difficult, and there is no excuse for them there, nor is it difficult to avoid them in many manufacturing processes, such as the baking of pottery and other furnaces dealing with incandescent material.

But there is one great application where the introduction of cool surfaces into the flame seems almost unavoidable, viz., the *firing of boilers.* It is to be hoped that gradually gas-engines will replace steam-engines and enable us to dispense with the rather primitive and unsatisfactory arrangement of obtaining power by the boiling of water. It is *impossible* to transfer heat with real economy from a furnace into a boiler. It is usually thought to be sufficient if all the heat generated is absorbed by the boiler, though even that is never fully accomplished. But suppose it were accomplished, there would be two great sources of loss still left ignored: one is the escape of unburned material already mentioned, and the other, and

much greater in amount, is the drop of temperature between furnace and boiler, concerning which there is much to be said, but briefly this: that it alone entails a loss of a great amount of available energy, more than seventy per cent. of the whole, for which there is nothing whatever to show.

Another condition for complete combustion is the adequate supply of air, unmixed with carbonic acid or other material. If enough air is not supplied, then the fire, stove or furnace becomes a sort of gas retort, the only difference being that in a gas retort no air is supplied at all, and the products are simply distilled away unburned. This happens in the early or black stages of a coal fire, but it is especially liable to happen in closed stoves and in other furnaces with doors. A quantity of coal is put on and gives off gas which bursts into flame, then the door is shut, the flame promptly goes out, and the gas is distilled up the chimney. If the door is opened it may catch alight again with a small explosion. Consequently the stoker takes care not to open the door until the gas is all gone and he is left with nothing but smouldering coke. Then he can open the door and repeat the process. The amount of senseless incombustion that goes on in common hand-fed stoves is something almost incredible, and only to be accounted for by a recognition not only of the dense ignorance of the uninstructed human race but by its obstinate stupidity also in being unwilling to learn, and thinking that its own habits are perfect and unimprovable.

Furnace stoking is managed much better, for its evident importance has directed a considerable amount of scientific attention to it. It is known that fresh fuel must be introduced either under or in front of a burning and red hot mass, so that the products of distillation may be raised up to combustion temperature before they escape. It is known also that sufficient air must be admitted if they are to be properly burnt, and that this air ought properly to be warmed by waste flue heat before introduction. Automatic stokers are made to continually feed in fresh fuel in the right place and way, but probably no automatic stoker can compete with highly intelligent hand feed. Stoking is an art, and a good stoker is a skilled artizan well worthy of appreciation.

In boiler furnaces, however, there is this difficulty, that if too much air is introduced combustion is too perfect, and the flame has insufficient *radiating power*. Moreover, even though the air is previously warmed up, as it ought to be, it exerts a considerable cooling influence, the cooling being mainly due to the great bulk of nitrogen in proportion to the active ingredient of the air.

3. The utilisation of the heat produced in boilers is most important, and demands illustration.

Heating by Radiation.

The right way, and indeed the only way, of conveying heat from a flame to a cool surface is by radiation. It is impossible to bring a flame into contact with a cool surface: the flame is extinguished where it touches, and a layer of non-conducting gas necessarily intervenes, across which the heat can only pass by radiation. Accordingly a luminous and somewhat smoky flame is necessary inside a boiler, unless the walls of the boiler are so thick or so covered with studs that the surface exposed to the flame may become red-hot and above the temperature of ignition. In that case the flame need not be extinguished, but may play upon them properly. This is a condition hard to satisfy, however, and so in some cases a luminous and to some extent smoky flame is necessary, and the combustion must be completed by air introduced beyond the boiler and before the smoke-stack.

A better plan is to introduce special solid material into the flame and keep it at a white heat so as to utilise its radiating power, on the principle of the gas-"mantle." A mantle radiates far more heat than even a luminous flame, and immensely more than the blue flame of perfect combustion; but the blue flame is the right one for keeping solid materials thoroughly hot, and these solid materials may in some cases be the walls of a combustion chamber, provided that the boiler surfaces are exposed to its glare. I shall not mention any specific device; I am dealing only with general scientific principles, but it is well known that more or less efficient methods of effective boiler-firing are growing in number. For steady work some of them suffice, but the difficulty of regulating the combustion of a coal-fed boiler under variable conditions is excessive; and whereas with a gas-fed boiler it would be easy to turn the gas on and off, with a coal-fed one the fire has to be banked up and kept in a black condition when not wanted, which is exactly the condition for smoke and destructive distillation without combustion.

There are many more things to say, and some points need more detailed treatment. Boiler furnaces are the only really difficult problem. Separate combustion chambers should be used for tubular boilers, so that cold surfaces shall not put out a flame. The radiating power of solid particles in flame is important, but the main moral is: Don't allow crude combustion of coal in towns, but supply them all day long with cheap gas from a distance.

IS LONDON FOG INEVITABLE?

By W. N. SHAW, D.Sc., F.R.S.
(FELLOW.)

THE consideration of this question has an important bearing upon the more immediately practical question of the abatement of coal smoke. No one will assert that there is anything physically impossible in the idea of dispensing with coal smoke. To find a substitute for our accustomed methods of warming and cooking (using the latter word in its widest sense), may be difficult or costly, but it is not impossible. But there may be some who are of opinion that if there are to be fogs in any case, the effort necessary to keep them clean is not worth the trouble and expense, and a review of certain facts and speculations which bear upon the question may be of some assistance.

Much work will have to be done before we can place our views of questions concerning fog beyond the region of speculation. Mr. Brodie, of the Meteorological Office, in a paper read last year before the Royal Meteorological Society, and discussed during the incidence of an unusually intense fog, gave statistics to show that there was in late years a decline in the frequency of fog in London; but whether that decline was due to a diminished number of occasions on which fog was meteorologically possible, or a diminished propensity in the London atmosphere to take advantage of such occasions, was not settled. There is no uniformity of practice as to the condition of the atmosphere that should be classed as fog. We do not know the actual course of events in the physical processes comprised in its origin and persistence, and until that stage is reached by patient experiment and close observation, the limitation of our power of dealing with such a question as that which forms the subject of this paper must be somewhat narrow.

A beginning was, however, made a few years ago on behalf of the Meteorological Council, with the material assistance of the London County Council, by Captain Carpenter and Mr. Lempfert, during the winters of 1901–2 and 1902–3 respectively.* Their reports enable us to

* "Report of the Meteorological Council upon an Inquiry into the Occurrence and Distribution of Fogs in London," 1904, and "London Fog Inquiry, Report to the Meteorological Council," by Captain Alfred Carpenter, R.N., D.S.O., 1903.

be more precise in matters concerning fog in London than was previously possible. In the first place, a scale of classification of fog by its effect upon traffic has been drawn up, and may be commended to those who desire comparable statistics for economic purposes. There can be no doubt that when we unexpectedly encounter a tramcar on the footway at a time of broad daylight, a fog which accounts for the incident may be called a thick one. It marks the complete paralysis of traffic, and in the country, when road margins are indistinguishable, and people lose their directions on account of fog, a high figure is rightly used to denote it. There are various gradations from this thickest fog, through the persistent smoke haze of the London streets in winter, to clear atmosphere. Of these intermediate gradations, the fog scale arranged by Captain Carpenter marks four, by the effect upon road and river traffic, for the purpose of classification, giving in all five numerical categories for the classification of fog. A considerable difficulty in forming a traffic scale of fog arises from the combination of fog with darkness. This difficulty is greater in the country, where there are no road lamps, than in towns with regular street lighting; but even in London the demoralisation of traffic becomes accentuated as darkness comes on at the close of a foggy day. Consequently some judgment and experience are required in estimating the density of fog on the traffic scale, 1 to 4, between 0 ("clear") and 5 ("street traffic impossible").

Captain Carpenter came to the conclusion that in the winter London was never free from a smoke haze; for some months of the winter when he was in charge of the observations, St. Paul's was invisible from the Victoria Tower, and although in the following year conditions were more favourable, there is no doubt that the entries of light fog (1 or 2 on the traffic scale) would be more frequently noted in London or other large towns than in the country, and that the abnormal frequency is due to smoke. Thus many light fogs may be attributed to smoke alone.

To form an estimate of what would be left if the smoke could be otherwise disposed of, we have to determine the cause of the formation and of the persistence of fog. This involves the identification of an extremely complex physical process comprising the cooling or warming of the air and the earth's surface, the supply of moisture and the prevalence or absence of wind, and this process has only been partially traced out in its details in actual practice.

The most frequent cause of fog is the cooling of the surface by radiation under a clear sky. As the air gets cooled by contact with the cold surface it flows gradually downward like a sluggish river slowly but surely

finding its way to lower levels. There is no limit to the extent of country which may be covered by this process. Just as nearly the whole of these islands was at one time covered with a coating of ice and snow that slowly worked its way towards the valleys, so at any time it may be covered with a vast sheet of cooled air slowly descending and becoming still colder as it descends, unless further radiation is prevented. Fog will form in the descending air if it becomes cold enough to go below the dew point. If the ground has been saturated with rain before the cooling began the dew point will be high and the formation of fog is all the more certain. Out of the thirty-nine cases dealt with in the winter of 1902-3 Mr. Lempfert assigns twenty-four to the effect of radiation of the kind mentioned, three to the slow passage during a change of weather of warm air over the surface which had been previously chilled, and four to the formation of cloud above the surface; eight he considered as consisting practically of smoke and nothing else.

Thus if the figures for that particular winter can be accepted as a guide, the Smoke Abatement Society has about twenty per cent. of London fogs to deal with absolutely, as the lawyers say. The remainder depend upon physical processes which are not within our control.

But from a certain point of view it may be said that the gradual extension of the London building area ought to tend towards the diminution of fog in London as compared with the country. One of the definite results of the fog inquiry is a recognition of the great prevalence of fog in the parks and open spaces, where the herbage and shrubs and other projections are cooled by radiation without any compensating warming from the ground, and thus they act as cooling agents for the air. A wood pavement if it is dry becomes similarly very cold on clear nights, but generally less so than the grass. House roofs become generally less cold than a dry wood pavement because they are kept warm from below. Thus one of the compensations for the diminution of open country in the immediate neighbourhood of London ought to be a diminution of the area in which radiation fog is formed most easily. London has now become so large that it is possible that this restriction of the conditions favourable for the formation of radiation fog has already produced a measurable effect. But such fogs are sometimes very wide spread; they may extend from the Mersey to the Thames, as they did in December of last year, and as the chilled air which carries the fog is always flowing gently downwards, it will collect in the great river estuaries. Thus we can scarcely hope that freedom from smoke will give us complete immunity from the fogs due to radiation.

Our knowledge of the conditions necessary for the dispersal of fog is still in a very primitive condition. In the Council's Report on London fogs it was suggested that the formation of fog tended to prevent the further cooling of the air near the ground, because the fog itself acted as a sort of blanket, and protected the surface from further chilling radiation. This idea seemed to be supported by the practice in vogue in the United States of making an artificial screen of smoke to cover the fruit trees as a protection against frost on a clear night, but in a letter Mr. J. Aitken, F.R.S., who has given very careful attention to the subject, demurs to the idea that the fog layer prevents further cooling. If I understand his meaning correctly the fog, or the upper part of it, radiates the heat instead of the surface, and the cooling goes on. It would add immensely to our information if we could find out what really happens when the sun shines on the fog layer. It may be taken as determined from meteorological observations that where fog is persistent throughout the day the temperature remains low, while the air of the neighbouring places free from fog gets warmed by the sun. Why the sun's heat does not dissipate the fog upon which it shines is one of the unsolved problems of this interesting subject.

Again, we can suggest a speculative explanation of the persistence of fog in London, though until it can be examined by observation it must remain only a speculation. The explanation is suggested by the character of early morning fogs that often occur in London. We find them even at 9 o'clock in the morning in October as white country fogs, particularly thick in or near the open spaces. But they probably have little vertical depth. The fog is carried in shallow layers of cold air. Over the top of it, probably, at that hour of the morning, is a layer of warmer smoky air that has been sent out from the London chimneys. This upper layer may take up some of the sun's heat and dissipate its influence upon the flood of cold fog-laden air that reaches up up to or a little above the house-tops. We are pushed, therefore, towards the inquiry whether the atmosphere of London has any special effect upon the heating power of sunshine. This is a question that can be easily answered from the report of the fog inquiry. The figures are given as a frontispiece to the final report where the results of the sunshine recorders at Westminster, Bunhill Row, and Kew are compared with those for the outside country. The recorders work by the burning of a card through the convergence of the sun's rays, so that they are just of the kind to give us the answer to the question we have put. The figures are eloquent enough. Bunhill Row loses 83 per cent. of the burning power of the

December sun, Westminster 61 per cent., Kew 15 per cent. The January figures tell a similar tale, so that we may be quite sure that if the sun has any substantial power of dissipating early morning fog, the smoke of the London atmosphere must seriously interfere with its effect.

However eloquent the figures may be, an actual comparison of the records is even more so. I have therefore had a diagram prepared, showing the daily records of sunshine at Bunhill Row, Westminster, and Cambridge for last December. They show a point which is not fully represented by the figures, namely that the sunshine that is measured is less strong in the smoky districts than elsewhere, and they afford very clear evidence of the interference with the sun's power of dissipating fog.

There are other points about London fog which await further investigation; for example, the peculiar manner in which the density varies from place to place, and the sudden local changes from light to darkness and back again. These are peculiar to town fogs, and must depend upon some processes which might, perhaps, be observed from a balloon above the fog, but at which, in the present state of our knowledge, we can only guess. Possibly they are connected with the general indraft of air towards London during fogs which was indicated both by Captain Carpenter and Mr. Lempfert, confirming the suggestion which had already been put forward by the Hon. Rollo Russell, but their connection with smoke is quite undetermined.

In so far, therefore, as anyone's action in regard to the smoke question may depend upon the effects of smoke on the frequency or intensity of fog, it would appear from such evidence as we possess that the abolition of coal smoke would cut off twenty per cent. of fogs altogether, that it would add most materially to the power of the sun to dissipate fogs and thus indirectly reduce their duration. The abolition of the dirt and the restoration of something like our natural heritage of daylight would be incidental advantages by no means unworthy of consideration.

OBITUARY.

H. H. COLLINS, F.R.I.B.A.

(FELLOW, AND MEMBER OF COUNCIL.)

By the death of the late Mr. Hyman Henry Collins, the Institute has lost a Member of Council who has been identified with the work of the Institute and of its predecessor since 1880, at which date he was elected a Fellow of the Sanitary Institute of Great Britain. He became a Member of Council in 1881; he served on the Special Committee to arrange a meeting at the Mansion House in connection with the Parkes Museum and was present at the meeting in February, 1885. When the Sanitary Institute was incorporated in 1889 he was elected a Member of Council, and served in that capacity up to the time of his death. He was for some time Chairman of the Finance Committee, and of the Parliamentary Committee.

Mr. Collins had been in practice as an architect for nearly fifty years. He was a Fellow of the Royal Institute of British Architects, a Fellow of the Surveyors' Institute, and District Surveyor for the Eastern Division of the City of London. As an architect he had an extensive practice in all kinds of buildings.

Mr. Collins was one of the early pioneers of sanitary reform, and was a very active member of the Social Science Association and the National Health Society. He at all times took the keenest interest in the work of The Royal Sanitary Institute, and his great experience and wise counsel were of exceeding value to his colleagues, who have expressed their sense of their loss in a vote of condolence sent to his family.

E. T. H.

NOTES FROM THE REPORTS OF THE MEDICAL OFFICERS OF HEALTH.

BUILDING A SEWER IN LOOSE SAND.

Extract from the Report of the Medical Officer of Health for Poplar for 1904,
F. W. ALEXANDER, M.R.C.S., D.P.H.

The following account of the construction of a sewer under considerable engineering difficulties is worthy of the attention of those who are studying practical hygiene:—

In his report the Borough Surveyor stated that the construction of new sewers for the Isle of Dogs was necessitated by the frequent flooding of the basement floors of many premises in Cubitt Town, on account of the old sewers having been insufficiently deep to allow of an adequate fall being given to the drain from the premises. In addition to this, however, the old sewers were found to be in a very defective condition, and far from watertight. When it is known that the London County Council have to deal with the whole of the sewage of this area by pumping at Abbey Mills, the importance of this in such water-logged strata as exists in the Isle of Dogs can be readily imagined.

In October, 1902, the Council approved a scheme presented by me for the construction of new 32-inch by 48-inch egg-shaped sewers composed of bricks and concrete, and 18-inch and 24-inch circular stoneware pipe sewers surrounded by concrete. The estimated cost was £16,820, but this was subsequently increased to £18,520 before the commencement of the work, to suit the requirements of the L.C.C.

The work was commenced on 26th January, 1903, at the lowest point, viz., the junction with the Manchester and East Ferry Roads, where the connection with the L.C.C. sewer was made.

During the progress of the work either ballast or clay was encountered in the lower strata until a point 100 feet north of Marshfield Street was reached. There, however, and onwards the lower strata proved to be of running sand, on which it was impossible to construct a sound sewer. The depth of this sand varied from 3 feet 6 inches to 5 feet to the solid bottom below the level of the foundation of the sewer, and this, consequently, necessitated either sheet piling and excavation or open piling with square piles. The latter method was adopted, the piles being driven through the loose sand and firmly imbedded in a solid foundation. It was found that as the numerous piles were driven down the

water was excluded, and what was previously loose wet sand became a compact mass and formed an excellent bottom to build upon.

A departure had to be made from this method of obtaining a firm bottom on proceeding further, on account of the sand containing too large a proportion of silt to allow of its compression. It was, therefore, decided to drive piles as usual and place longitudinally on the top thereof 50-lb. steel rails, fish-plated, bolted and brogged on to the piles. On these rails when fixed in position 3-inch York stone slabs were placed, and on the stone the invert blocks were laid, the sewer being then built up in the ordinary fashion. In places the strata of silt ran higher, and in such cases the sloppy silt was entirely removed and hardcore and cement concrete substituted.

A length of over 1,000 yards was dealt with either in one or other of the methods above described, and many other difficulties overcome. Some idea may be formed of these when I mention that throughout the whole length of the works not more than 200 yards proved sufficiently good to build upon without special treatment.

The total cost of the work has been £21,231 8s. 8d., and the estimate, together with a supplementary estimate of £2,000 put forward during the progress of the work, amounted to £20,520. £11,539 14s. 9d. has been paid in wages, and the Establishment charges included in the above cost amounted to £1,154.

The following information as to the length of sewers and quantities of material used may be of interest:—

Length of brick sewer constructed	..	4,590 feet.
Length of 18-inch pipe sewer laid	..	3,336 feet.
Length of 24-inch pipe sewer laid	..	950 feet.

Volume XXVII. No. 2. Issued March, 1906.

JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

CONFERENCE ON SMOKE ABATEMENT.

Wednesday, December 13th, 1905.

SUBJECT: "DOMESTIC SMOKE ABATEMENT."

ADDRESS

By SIR GEORGE LIVESEY, M.Inst.C.E., M.I.M.E.

TO induce an individual to change a long-fixed habit or practice is a very difficult matter, unless it can be shown to be decidedly to his interest and advantage. To change the habit or practice of the inhabitants of a great city can only be undertaken by enthusiasts, who must be gifted with exhaustless patience and perseverance, for at the best they cannot hope to see anything but a very gradual change. But there is hope for London; the abatement of its smoke has begun. To estimate the proportion of the smoke of London due to domestic fires is impossible. It is certainly very large and greatly in excess of that produced by factories, etc. On a still day even a few cottages will fill a country valley with smoke, as I once saw with astonishment; and I often see from a hillside overlooking the lower part of a town the great amount of smoke from a few hundreds of small houses. In fact, if domestic smoke could be abolished, that from factories would be found to be less than is commonly supposed, and would cause little trouble. Gaseous firing, the gas engine, and the dynamo are potent agents for the diminution of factory smoke.

I can only suppose that my connection with the supply of gas in London is the reason why I have been asked to occupy the honourable position of chairman at to-day's Conference, in order that the information bearing on smoke abatement possessed by the gas companies might be given, and possibly some indication of further steps in the direction of gaseous fuel that may be taken. If (and it is certainly a big *if*) a suitable

gaseous fuel, at a low price, could be substituted for the bituminous coal now used so largely, the trouble would be ended. The improvement that has taken place during the last twenty years, much more in the later than in the earlier ten years, is due to the substitution of gas for coal by the general adoption of gas cooking stoves by all classes, and particularly the wage-earners. The smoke from cooking is an old source of trouble, for the other day I found these quaint lines:—

"Observe how the chimneys
Do smoke all about;
The cooks are providing
For dinner no doubt."
From *Poor Robin's Almanack* (1695).

The following figures will show how this source of smoke is being diminished. I have been obligingly furnished by my friends, Mr. Watson, the General Manager of the Gas Light Company, and Mr. Stanley Jones, Engineer of the Commercial Gas Company, with the number of cooking stoves, etc., so far as is known to them. I only give the statistics for the three Metropolitan companies, but all the suburban companies are working on the same lines. Within the last ten or twelve years, by the introduction of the penny-in-the-slot meter, almost the whole of the wage-earning classes of London have been supplied with gas, whereas previously not one in a hundred used gas, for which there were two reasons, the cost of fitting up their houses and the periodic collection of the gas accounts. The gas companies now fit up the houses and tenements, providing meter, cooking stove, pipes, fittings, and burners; all, including the gas, being paid for by the pennies put into the meter.

Cooking Stoves in use in the Districts of the Three Metropolitan Gas Companies.

	Ordinary Consumers.	Cooking Stoves.	Slot Meter Consumers.	Cooking Stoves.
The Gas Light	252,273	101,545 = 40 %	214,961	164,699 = 76 %
South Metropolitan	108,305	82,370 = 76 %	188,729	161,344 = 85 %
Commercial	25,000	9,000 = 36 %	45,000	28,450 = 63 %
Totals	385,578	192,915 = 50 %	448,690	354,493 = 79 %

	Total Consumers.	Total Cooking Stoves.
Ordinary	385,578	192,915 = 50 %
Slot Meter	448,690	354,493 = 79 %
Grand Total	834,268	547,408 = 65 %

These figures are an under-statement, being only those known to the gas companies as stoves let on hire or sold to consumers; but some consumers have purchased stoves of the makers. It will therefore be safe to say that of the 834,000 consumers supplied with gas by these three companies, about 70 per cent., or 584,000 use gas stoves for cooking. The only reason why it is not 100 per cent. in the case of the slot-meter consumers is that in a certain number of their habitations a cooker cannot be fixed, sometimes because there is no place for it and in other cases because the landlords will not permit it. One of the greatest and best of the philanthropic trusts for a long time refused permission to fix a stove in their buildings, and now that objection has been overcome it is found that in a large proportion of their tenements there is no place for the gas cooker, they having provided good ordinary ranges to burn solid fuel.

From the King's palace to the cottage or the small tenement of the workman, from the small room occupied by a single man or woman to the largest business and other establishments where hundreds are fed daily, gas is used for cooking. The demand for gas cookers is still maintained, the three companies supplying not less than 700 to 800 a week; and if the other companies in the immediate suburbs are included, the new cookers fixed in all London must average about 1,000 a week. Substitute coal for all this gas and what would be the condition of London?

But this result has been obtained by slow degrees. The first introducers of gas stoves were the late Mr. Sharp, of the Southampton Gas Company, I think in the forties, and shortly afterwards the late Mr. Goddard, of Ipswich, the father of the Member of Parliament for that borough. Prior to 1850 the cooking in my father's house was done by gas, but only by very slow degrees did it become general. For about thirty years, and in some places longer, the gas companies left the introduction of cooking stoves to the makers and to the consumers, who had to purchase them outright, with the result that comparatively few came into use. It is to the system of letting on hire at a quarterly rental to ordinary consumers and to the supply of stoves with the slot meters that the present position is due. I am afraid I cannot say that the question of smoke abatement has had anything whatever to do with it. The gas companies simply desired to increase their business, and the consumers found it advantageous to use gas for cooking; the necessary facilities were given and that is all. It will be no departure from truth to say that not a single gas cooking stove has been fixed with the object of preventing smoke; in fact, that worthy object has never been considered by the

parties, but, *hey, presto!* it has, so far as cooking is concerned, been accomplished.

There remains a more difficult task for the advocates of smoke abatement, on which, if they are to succeed, they must concentrate their attention. The domestic fire used for heating is the problem. It needs extreme care, suitable appliances and expert knowledge to burn bituminous coal in a steam boiler or factory furnace generally, without smoke. It is vain to expect such a combination in the case of the domestic fire, though it may be improved. The main hope, therefore, lies either in smokeless solid fuel or gaseous fuel of some kind. The only solid smokeless fuels at present available are anthracite and coke. The former is not burnt in the ordinary domestic grate, and although the latter can be so burnt it has not been extensively adopted, except in small houses, and not by any means generally. Coke, no doubt, is best when used in close stoves, and is very effective, and the same may be said of anthracite. Abroad, close stoves are common, but England will have none of them for the heating of sitting-rooms.

We have been too long used to the cheerful open fire (which, in addition to its cheerfulness, serves another most useful purpose, as a ventilator) to give it up without good reason. Constructed as our houses usually are, we have to depend for ventilation on the chimney. I have had a number of experiments made in eight rooms, which show that in ordinary dwelling-houses the chimney, when the fire is burning, will take away about five times the cubical contents of the room in an hour, in some cases slightly less, and in others considerably more, the range being from 7,400 cubic feet an hour in a cottage bedroom (cubic contents about 1,000 feet and a chimney 10 feet high) to 17,200 in that of an ordinary dwelling-house, in a sitting-room of 2,104 cubic feet contents. In this case the chimney is 45 feet high above the fireplace. The lowest ratio in the eight experiments was five times, and the highest about ten times the quantity of air equal to the cubical contents of the room in an hour, that is where a fire, in some cases a gas fire, was burning. In one room of the cottage where there was no fire there was no measureable draught up the chimney. The air in a room with the window shut is not so fresh in the summer as in the winter, owing to the absence of the fire to create a draught up the chimney. The great importance of a good draught up the chimney is therefore clear, and is a justification for the open fire against the closed stoves. Gas fires are often so placed as to partially block up the chimney and thus check the flow of air, which is

probably the reason why complaints are sometimes made against them. This, however, can be, and is, in many cases, avoided. The chief objection to gas for heating is that it is more costly than coal when the fire is required throughout the day. Therefore the inhabitants of our towns will not adopt gas generally, even to please the Smoke Abatement Society. Give them heating as efficient, as convenient, and as cheap as the coal fire, and they will in time (for the householder is very conservative) adopt gas generally. As to convenience and cleanliness in the house, gas has a great advantage over coal, which is one point in its favour. And for efficiency and ventilation it can hold its ground, but its price is the crucial point. It is, however, used more extensively than is generally supposed. The exact number of gas fires in use can only be estimated, because in the majority of cases they are purchased by the consumers. The South Metropolitan Company have 19,765 on hire, but this is no measure of the total. A canvass has been made in a number of streets, mostly of private houses, with the result that 38 per cent. of the ordinary consumers have gas fires in their houses, with an average of two fires to each house.

The following is the list of the places canvassed:—

Place.	Number of Houses Canvassed.	Number of Gas Fires.		Number of Incandescent Burners.		Number of Consumers using Cooking Stoves.
		Consumers.	Fires.	Consumers.	Burners.	
Kennington Park Road	93	27	46	77	355	71
Narbonne Avenue, S.W.	100	37	45	96	365	96
Burnt Ash Hill, S.E.	78	52	124	53	250	44
Stockwell Park Road	68	22	37	48	235	57
Camberwell Grove	63	24	42	53	342	41
Wickham Road, Brockley	52	38	100	38	271	34
Louisville Road, Upper Tooting ...	123	41	88	115	571	106
Norwood Road	98	39	71	83	420	78
New Cross Road	60	14	35	54	253	42
Wrottesley Road, Plumstead ...	72	27	43	62	268	63
Maryon Road, Woolwich	83	25	42	74	457	76
Lee Road	74	30	94	48	189	36
Trinity Street, Southwark	33	3	3	28	133	17
	997	379	770	829	4,109	761
		38%	Average 2 to each	83%	Average 5 to each	76%

The great desideratum for smoke abatement is cheap gaseous fuel. Fortunately illuminating gas, thanks to the Welsbach mantle, is no longer necessary, heating power being the only requirement. To use gas with a

luminous flame burner is now nothing less than unjustifiable extravagance. As shown in the above table over 80 per cent. of the consumers use the mantle, and in a short time it is hoped that it will be as difficult in England as it is in Germany to find a flat flame burner in use.

This being the position, there is no real obstacle to the supply of one quality of gas for all purposes. Prior to the introduction of the mantle it was held that if fuel gas were wanted it would have to be supplied in separate mains, and this would have been impracticable. There is not room in the roadways for another complete set of large gas mains. Now, however, an eight-candle gas would answer all purposes. An entirely non-luminous gas would do but that there are passages and cellars and other out-of-the-way places where a small light is necessary, and this can be better obtained by an ordinary burner than by the use of a mantle.

There are, however, two difficulties in the way. In London the County Council have put every possible obstacle in the way of all the gas companies' efforts to obtain Parliamentary sanction to reduce illuminating power, and in the meantime the production of cheap gas suitable for all purposes is delayed. This struggle began in 1900 and is still going on; a notable advance having recently been made in the shape of a just method of testing gas. For nearly forty years have the companies been subjected to a system of testing that entailed enormous expense and constant worrying anxiety, with no advantage to the public. This great waste of the money of the consumers and ratepayers is due to the mistaken idea of the London County Council that every proposal of the gas companies must be at variance with the public interest. The gas companies have no monopoly now, but are subject to fierce competition. If they do not supply the article the consumers want they lose business. The restrictions imposed by Parliament (when they had an absolute monopoly and gas was the only practicable artificial light, the choice being between ordinary tallow candles, or oil at from 5s. to 7s. a gallon) are now not only useless but mischievous, because they stand in the way of the production of cheap gaseous fuel, which I believe to be the great desideratum for the prevention of smoke.

The second difficulty is that we have not yet found the gaseous fuel suitable for the purpose, which can only come by slow degrees. We want freedom to work in that direction. The just method of testing mentioned above, to come into force in the New Year, will give us a certain measure of freedom to start towards the goal of a cheap fuel gas.

It is in these means that, in my opinion, lies the best hope of success in the abolition of smoke. It can come only by providing the public with

means to supply their needs for heat and light that will suit them better than those at present available. The domestic fire is the point to attack, and this will not be given up for sentimental reasons. No householder will give up his coal fire simply to prevent a smoky atmosphere, but if an efficient and cheap substitute can be found then a gradual change will be made. Legislation to control the householder in this matter is futile, and I hope The Royal Sanitary Institute and the Smoke Abatement Society will not follow the Socialists in the belief that everything can be done by Acts of Parliament. As much freedom as possible is what we want if we are to progress; but put not trust in legislation, which means restriction. The boy who said that pins had saved many lives explained that it was by people *not* swallowing them, and in like manner Parliament does a great deal of good by *not* passing many of the Acts introduced every Session, and as many of those now on the Statute Book are productive of harm, Parliament might be much worse employed than in repealing those that are unnecessary and mischievous.

THE ABATEMENT OF SMOKE FROM PRIVATE HOUSES.

By H. A. DES VŒUX, M.D.

THE five million inhabitants of London are each and all adversely affected by the smoke which thickens our atmosphere from one year's end to another; and what then is the reason why so few can be induced to join the smoke abatement crusade when all would be the gainers thereby? I think it is this. For more than five hundred years coal has been brought to London for consumption in fires, and for all that length of time smoke has been added to the atmosphere; and it was not imagined that the amount of smoke could be diminished either from factory or domestic chimneys, and no other satisfactory method of heating was tried or perhaps known. The impression was that heat must be produced; coal is the only source of our heat; smoke is a necessary result of coal-burning.

It is my duty to point out some means by which smoke from private houses can be avoided. In the majority of English houses, the cooking is still done by coal in an open fire, and sitting-rooms and bedrooms are heated in a similar manner; while most people would consider it an act of tyranny if they had to change their ways, which, if they are dirty and inefficient, do not seem to them very costly.

To see what could be done to improve coal fires, the Coal Smoke Abatement Society (to whom every assistance was given by His Majesty's Office of Works) carried out two series of tests, see *The Lancet* of May 10th, 1902, and February 20th, 1904. A further and much larger series has just been carried out in the new Government offices in Great George Street, under the superintendence of Sir Henry Tanner (principal architect to H.M. Office of Works) in conjunction with a small sub-committee of the Coal Smoke Abatement Society. Broadly speaking, it may be said that there is no such thing as a smokeless open coal-fire, but, under efficient management, there are vast differences in the smokiness of fires, those which give the greatest amount of heat for the least amount of coal

consumed emit the smallest amount of smoke, and therefore efficient coal fires are to a certain extent smoke abaters.

If you want your atmosphere cleared of smoke, you will have to give up the use of crude bituminous coal and to use some of its products, such as gas or electricity, or some smokeless fuel. Our cooks have already found out that a gas-kitchener is essential, and have discovered its advantages. But, unfortunately, smoke is still emitted from the kitchen-chimney, for in all moderately large houses it is necessary to have a hot-water system as well, and in most houses the old coal-range is lighted for this purpose. Eight years ago I installed a coke-boiler, which has given a magnificent hot-water supply throughout the house at a temperature of about 170° F., and the supply has been so plentiful that I have been enabled to put on three hot-water radiators in passages. The cost of this system is from 1s. 3d. to 2s. a week, depending mostly on the price of coke. If a gas-cooker and a coke-boiler were installed in all the houses in London, the greater part of the smoke from private houses would be prevented. When we come to the sitting- and bed-rooms our problem becomes easier: I myself have a gas log fire in my consulting-room, an anthracite closed stove in my dining-room, an open coal fire (the Florence grate) in my morning-room, and gas fires in my bed-rooms. The objections made to gas fires are the reputed drying of the atmosphere, the sentimental points that they are not so pleasant to look upon, and that they cannot be poked! The last is trivial, but the second has some force, on account of the pleasant sensation from the sight of a bright-burning coal fire. The first objection is a real one, if true. I find that with a gas-fire in a room with no ventilation, a peculiar sensation of dryness is produced, but that it is readily removed by opening the window an inch or two. This is therefore an advantage, and not a draw-back; and there is certainly less draught in a room with a gas fire than in one with a coal fire.

The Lancet's article of November 26th, 1893, on heating and cooking by gas, unhesitatingly recommended gas for both purposes. It takes for granted that a gas-fire dries a room more than a coal-fire, and states that this can easily be altered by the use of a bowl of water. But the drying of the atmosphere was not proved by analysis, and it has since been denied by competent authorities. I think that it is a subject which the gas companies might profitably take in hand. Whenever a complaint is made as to fumes or dryness from a gas-fire, an analysis should be made of the atmosphere of the room and the gases in the

chimney, and I feel no doubt that we should soon be at the bottom of this frequent cause of disparagement of gas-fires. With regard to cost, in my own house cooking by gas is slightly (ten per cent. or less) dearer than by coal; I append some figures showing the enormous increase in the employment of gas-stoves during the last ten years; since small consumers and poorer people are using them more and more. A lady writes to me that she often goes to bed without food, rather than go to the exertion of lighting her coal-fire. On my advice she installed a penny-in-the-slot gas stove, and besides the comfort, finds it much cheaper than coal, costing on an average 1s. 2d. a week, against 1s. 8d. for coals. Messrs. Lyons, the well-known restaurateurs, spend £10,000 per annum on gas for cooking.

Electric heaters, anthracite-stoves open or closed, coke and other smokeless fuels, are also available for sitting-rooms. The first are becoming more frequent since the electric companies reduced their prices for current; emitting no smoke and no fumes, they are bright and cheery, requiring only a switch to turn them on and off, but they do not help in the ventilation.

Anthracite open fires are absolutely smokeless, give a great heat, and are efficient ventilators, but the fire is not so bright or quite so lively as a bituminous coal-fire, and it is somewhat difficult to light. I believe that they are not costly, although the coal is dearer.

Closed stoves, mostly French and German burning anthracite, are more and more used; they are alight night and day, need only be stoked once in twenty-four hours; are very economical (mine only costs 3d. for twenty-four hours), but they are cheerless things, and in my opinion are best fitted for dining-rooms, which are only used at certain intervals of the day, or in halls or passages, where they are excellent.

Of oil-stoves I need say little, they are cheap and economical, useful in halls and passages, but not quite suitable for sitting-rooms and bed-rooms.

Hot water and steam systems through a house are not common in England, but I think that by reason of their economy and labour-saving advantages they will be more employed.

In proving that the problem of abating a smoky atmosphere from house-warming is not a hopeless one, I have no wish to push gas as against electricity, anthracite coal or coke. Smokeless cooking will rid us of 600,000 dirty chimneys, and the effect will be enormous. Smokeless heating will follow in due time, and for those who insist on having an open coal-fire, it should be a *sine qua non* that only those grates are

allowed which have already been tested by some public authority as to their efficiency.

Increase of Gas Cookers bought or hired from Gas Companies in 10 years, 1895–1904.

Metropolis and Suburbs.

Using Penny-in-Slot meters	365,000	535,000
„ Ordinary meters	170,000	

Twenty Provincial Towns.

Using Penny in Slot meters	135,000	315,000
„ Ordinary meters	180,000	
Total Increase in 10 years		850,000

Most of the huge installations of cooking ranges for clubs, restaurants, hospitals, etc., are not bought through gas companies.

Increase of Heating Stoves bought or hired from Gas Companies, 10 years, 1895–1904.

Metropolis and Suburbs	120,000
Provincial Towns	50,000
	170,000

It is probable that a much larger number of heating stoves are bought from makers or ironmongers than from gas companies.

COKE (CHARRED COAL) AS DOMESTIC FUEL.

By SIR CHARLES COOKSON, C.B., K.C.M.G.

I HERE give my experience of the use of coke as the only fuel in all the grates in my own house. One grate is a Garland of the most approved modern pattern; three are of the ordinary 18th or 19th century make, two are large open grates belonging to the old sitting-rooms of the original mansion, and the seventh is an ordinary kitchen range with hot plates and boiler. For roasting, a separate movable gas stove has been found necessary. No bituminous coal but only the coke sold by the Gas Light and Coke Company has been used for five years, and in no case is any special apparatus or grate required.

Coming to live in London from sunny Egypt, and disgusted at the contrast of the atmosphere, I determined not to contribute to the nuisance, and to burn only smokeless fuel. I tried anthracite for a time, but soon took to coke on account of its greater cheapness as well as its far higher power of radiating heat. The initial difficulty of both these smokeless fuels was in lighting them; but I easily overcame this by putting under the grate an iron pipe, connected with the gas service of the house and perforated by air-holes at the side, so that the gas when lit reaches the coke laid on the lower bars of the grate. The flow of gas is controlled by a Bunsen burner, higher up in the pipe. I find that the gas takes about ten minutes to ignite the coke, and that the average consumption in that time is something less than six feet. The fire is kept up for the rest of the day by coke alone. This is much the best method of igniting, but if the fire is lit in the ordinary fashion with common coal, after that has once become heated there is no difficulty in using coke only for the rest of the day, and the smoke is reduced to a minimum. I believe I have satisfactorily solved the question of the abolition of that large part of the smoke nuisance which arises from the domestic chimney. Incidental advantages of the method are:—

(*a*) At the present price of broken coke, 12s. for 12 cwts., its cost is nearly half that of household coal, and is still cheaper in comparison with inferior coal which the poor are obliged to buy in small quantities. Wood or other kindling material costs about 5d. or 6d. a week for every fire; but the consumption of six feet of gas per diem at the current price costs no more than ½d. per week.

(*b*) The fire can be lit at any time without trouble, and the gas flame gives an immediate heat up to the moment that the coke is ignited.

(*c*) Coke, the lumps of which never cake, very soon gives a glowing mass of fuel, and radiates greater heat than any other house-heating combustible.

(*d*) Absence of smoke from the room causes cleanliness in furniture, upholstery and wearing apparel, and saves quite 50 per cent. in cleaning. Any fine dust from the ash of the coke is not dirty; there is no damage like that from soot to furniture or books, and no expense and trouble from sweeping chimneys.

Coke is far cheaper than anthracite, and radiates a much greater heat. It is much more economical than gas, electricity, and special smoke-preventing apparatus, and requires no alteration in any grate now in use. It further satisfies the preference of the British public for the cheerful aspect of a fire in the open grate. I have no hesitation in saying that there is no foundation whatever for the complaint that it gives out unhealthy fumes. Of course, where there is not sufficient draught through the fire some of the gases which are imperfectly consumed are liable to escape into the room. But though I have seen coke used in very small grates in very small rooms, I have never known any complaints on this head; and wherever this difficulty exists there are obvious means of curing it by producing an artificial draught. On this important point I hope to be supported by testimony from those who have successfully burnt coke in their own houses.

A real objection is that nearly all our coke is at present a by-product of gas-retorts, and its quantity is insufficient to meet such a demand in London alone. The only remedy is to produce a "*charred coal*," which, after utilising a part only of its valuable volatile by-products, could still be sold at a lower price than that of bituminous coal, as has been done in Germany and elsewhere. Charred coal is produced by a newly invented and more economical pattern of coking-oven in Germany, for 8 marks per 1,000 kils. (equal to 1 ton); and there is no doubt that its quality could be improved. If manufactured in England, it could be delivered in

London at a proportionately small cost. To those who still prefer the look of a lively coal fire with its lambent flames, I would recommend a trial of the effect of a "ship's log" on the top of a glowing coke fire.

The plan I advocate in this paper, if universally adopted, would save London alone £5,000,000 a year, besides removing the curse of smoke.

It was only subsequent to the experiences detailed in this paper that I became acquainted with valuable suggestions in the same sense in connexion with a great scheme for "The Heat, Light, and Power Requirements of London," in *Page's Magazine* for April, 1905, and elsewhere, by the eminent engineer, Mr. B. H. Thwaite. He anticipated much of the contents of this paper.

A RECORD OF THE WORK OF THE LEEDS SMOKE ABATEMENT SOCIETY.

By Prof. J. B. COHEN, Ph.D., B.Sc,

The University, Leeds.

THE Society was formed in 1890, (1) To determine the nature and extent of atmospheric impurities arising from coal smoke, (2) To consider the question of coal consumption in boilers, furnaces, and domestic fire-places, (3) To examine the efficiency of the present system for controlling the emission of smoke.

A calculation of the amount of soot in the air of Leeds, as half per cent. on all the coal burnt, gives much too low a figure for *domestic* coal, which yielded by experiment an average of 5 per cent. of soot with the better qualities of coal. But at half per cent., the daily consumption of 4,000 tons in Leeds means twenty tons of soot, and a similar figure was obtained by aspirating large quantities of air through a weighed plug of cotton wool. Most of the soot is blown away, but we find that about half a ton falls in Leeds each day. This figure was obtained in January, 1892, when a square yard of snow was removed daily from the parish churchyard, the snow melted, and the soot estimated. Most of the daily soot-fall is washed away in time, but as it contains about 15 per cent. of a sticky oil by means of which it adheres and quickly discolours brick and stone work, not to speak of fabrics, furniture and clothes, at least 25 lbs. per day sticks and is not removed by rain. This was determined by means of glass plates exposed at some distance from chimneys, and examined every few weeks. Those exposed at about nine miles from Leeds remained almost clean. In addition to the sulphurous acid and soot, the loss of light was also estimated daily at different stations in 1895–96, and showed a considerable difference in the town. These examinations convinced us of the substantial nature of the nuisance.

The means of diminishing the evil by the better consumption of fuel

had already been attacked, as regards boiler-furnaces, by Mr. Herbert Fletcher of Bolton, for the Manchester Smoke Abatement Society, and a valuable report in 1896 on his tests, with those of other observers, concludes that "a manufacturing district might be free from manufacturing smoke, at least from steam boilers."

The evil of smoke might be met if more attention were paid to the use of gas-fires. In numerous experiments as to their products of combustion and heating effect, with a proper chimney-draught, I have never found any emission of noxious gases into a room, nor any carbonic oxide even in the flue-gases. The heating effect when burning about 22 cubic feet of gas per hour, is greater than that of 3 lbs. of coal per hour in an ordinary fire-grate, but the cost of the gas is almost double. One defect of gas-fires that ought to be easily remedied, is that, unlike a coal fireplace, they produce very little ventilation.

As to the third item, the efficiency of the method of control, the Leeds by-law limits the duration of black smoke from factory chimneys to five minutes in the hour. Manchester only allows one minute, and I believe that Nottingham, in the interest of the lace-industry, only permits five minutes in the morning of each day. In our own inspection for three weeks at Leeds, out of 79 boiler chimneys 51 emitted black, opaque smoke for over ten minutes in the hour. Yet the convictions for smoke nuisance are ludicrously few: in one year, there was only one, and the average is six per annum, with a fine of 10s. each.

The Society soon decided as to the best mode of treating the problem, on the lines of an annual report of the former chief alkali inspector, Mr. A. E. Fletcher. "The complaints that are brought against the emission of black smoke from factory chimneys are numerous, but too intermittent and desultory to bring about much diminution of the evil. The Alkali Act gives no power to control common coal smoke, yet at two points it comes so near it, that the question has often received my close attention. . . . . Masters will not take the trouble to alter their furnaces nor will the men alter their method of stoking their fires unless they are compelled. The numberless alterations made in the construction and conduct of chemical works during the last twenty years would never have been carried out, but for the pressure brought on the manufacturers by means of the Alkali Act."

Our Society therefore resolved to press for an extension of the Alkali Act bringing the chimneys of all works under the same kind of control, to memorialize the Local Government Board for the appointment of

Government inspectors, and with this object to join forces with the Manchester Smoke Abatement League and the Sheffield Smoke Abatement Society. The memorial was very largely signed by all the principal Sanitary, Medical, Architectural and Botanical Societies in Lancashire, Yorkshire and elsewhere, and resolutions in favour of it were received from Trades Councils and other representative bodies; but it was never presented, as the Local Government Board declined to receive either deputation or memorial. Nevertheless, we in the North are still convinced that these are the lines which are most conducive to the effective solution of the smoke problem.

THE ACIDS OF SMOKE.

BY SAMUEL RIDEAL, D.Sc.Lond., F.I.C.

(FELLOW.)

IN discussions on the smoke-question the evil effects arising from the acid gases, which are associated with all kinds of coal-smoke, are frequently overlooked. Penalties can only be recovered when black smoke is emitted; but as the colour is only a measure of the amount of smoke escaping, it does not give even approximately the amount of associated acids. It is evident that the Legislature has regarded the nuisance as one which only affected the amount of light to which the inhabitants of towns were entitled, and the chief defect in working the Act was due to vagueness in defining what this phrase "black smoke" means. For many years past it has been thought desirable to eliminate the word *black* from the definition in the Act and make it applicable to smoke, irrespective of colour, as it is obvious that although the light obscured may sometimes be less, the total effect after the smoke is dissipated must depend upon the proportion of unconsumed coal which passes into the air. Such an extension would, however, leave untouched the question as to the injurious effect of acids produced in the ordinary combustion of coal, and even if mechanical stokers, and other means of preventing the issue of unconsumed particles into the air, are used, the quantity of sulphur-acids produced will remain the same.

During the past fifteen years I have had to examine the atmospheres of town and country with a view to determining the amounts of sulphurous and sulphuric acids, and have found that these two acids always increase in foggy weather and are normally present to a greater extent in the air of towns than in rural districts. It is easy to calculate from the quantity of volatile sulphur in coal, the amount of sulphur-acids produced in a district, in a given time, when the coal-consumption is known. In London, about sixteen million tons of coal are used per annum directly for heating purposes, and the sulphur-content of this coal may range from 1 to 2 per cent., giving an annual production of half-a-million to a million tons of sulphuric acid which is diffused in the air.

Condensation and rain remove the acid gases from the air, as they are readily soluble in water. Fountains, like those at Trafalgar Square, act as scrubbers of the air and should be encouraged by municipal authorities, so as to diminish the quantity of soluble acid constituents in the air. The analysis of rain-water collected in the neighbourhood of towns and its marked action upon galvanised iron and other easily attacked metals, on exposed fabrics, and on building stones and mortar, prove the prevalence and injurious effect of the acid impurities. It has been shown by many analyses that the surface of buildings and outside sculptures becomes converted into a crust of sulphates, and along with the corrosion there is a roughening on which carbon settles, making the well-known black streaks or stains.

Dolomite limestone (*e.g.*, Westminster Palace) is the stone which appears to be most affected, owing to the solubility of the magnesium sulphate formed. The Oolitic limestones (*e.g.*, St. Paul's), which contain little or no magnesium carbonate, are far more durable in acid town-air. A baryta-wash seems to be one of the best antidotes.

From the results of a large number of analyses of the air of London, Manchester and Liverpool, a report of the Air Analysis Committee of Manchester, in conjunction with the Royal Horticultural Society, concluded that:—

1. In clear breezy weather the amount of sulphurous acid is less than 1 milligramme (·015 grain) per 100 cubic feet of air.

2. In anticyclonic periods it rises very considerably, and in times of fog, 34 to 50 milligrammes (0·51 to 0·77 grains) have been recorded for the worst districts of Manchester and London respectively.

3. Wherever an open space or a less densely populated area occurs, there is a marked diminution in the amount of impurities in the air.

4. Increase in the amount of sulphurous acid is accompanied by at least as large an increase in the amount of organic impurities in the air.

5. Smoke, promoting as it does the formation of fog, and preventing diffusion into the upper stratum of the air, is the principal cause of the impure state of the atmosphere in large towns.

In 1891–2 there was an extended investigation of the subject, in which I was engaged with others, and the following table gives a summary of the results, with some additional ones since obtained:—

Sulphur in grains per 100 *cubic feet.*

Locality.	Averages, Nov.—April.	Mean for the rest of the Year.	Maximum.	Minimum.
MANCHESTER. 1891–92.				
Owens College	·039	·017		
Hulme	·048	·024		
Town Hall	·057	·017		
Ordsall	·058	·026	·198 December	·003 October
Mean of the four localities	·050	·021		
LONDON. 1891–92.				
St. George's Hospital (Rideal)	·050	......	·120 December	·004 December
University College, Gower Street	·081 November	......	·244 December	·029 November
LONDON. 1903.				
Victoria St. (Rideal), March	·009	......	·012	·004
Old Kent Road, November	·0162	......	·025	·009
„ „ „ December	·0165	......	·022	·008
LILLE, 1884 (Ladureau)	·100	......	·120	·080
Country air:				
Hanover, 1900 (H. Ost)	......	·012 whole year		
Elstead, Surrey (Rideal), Dec., 1903	......	·001		

The following details from the results at Gower Street show the difference caused by atmospheric conditions in short intervals of time:—

Sulphur in grains per 100 *cubic feet.*

Dull Days.			*Foggy Days.*		
Nov. 5th.	Dull	·034	Nov. 24th.	Slight fog	·064
„ 6th.	„	·029	„ 30th.	Dark and very foggy	·107
„ 10th.	„	·042	Dec. 21st.	Yellow fog	·128
„ 13th.	„	·053	„ 22nd.	Dense black fog	·244
„ 17th.	Slight fog	·051	„ 23rd.	Yellow fog	·081
„ 20th.	Dull	·042	„ 24th.	Thick yellow fog	·128

The detrimental action of urban fog on plants is due not so much to sulphur-compounds, as to the deficiency of light, the cold dampness and the deposit of tarry substances, soot and dust. In a series of experiments on growing plants made in 1903, I found that a proportion of pure diluted sulphurous acid gas many times greater than that present in a thick yellow fog, was tolerated, the effect being only comparable to that of a change of a few degrees in temperature or of a moderate reduction of light.

Coal-soot and dust are also found to concentrate the sulphur compounds; for instance, samples of soot in London contained 4·6, in

Manchester 4·3, and in Glasgow 7·9 per cent. of SO_3, equal to 1·84, 1·72 and 3·16 per cent. of sulphur respectively. From experiments at Leeds and Manchester it was estimated that the soot which fell in 24 hours per square mile, was in the former place 250lbs., and in the latter about double that quantity during fog. The dust from 20 square yards of glass roofs at Kew and Chelsea, contained nearly 5 per cent. of SO_3, equal to 2 per cent. of sulphur. A concentration also occurs from rain and snow. These, in Manchester, were found to contain, on 22 days between November and August, an average of 1·46 grains SO_3 (=0·58 S) per gallon, with a minimum of 0·18 and a maximum of 4·94. At Lille the rain-water contained sulphur compounds corresponding to 1·54 grains per gallon of SO_3, equal to 0·62 grains of sulphur.

As to the amount of sulphur sent into the atmosphere as acid gases every day in London by the three chief combustibles, I have calculated it from Board of Trade returns of the average quantities used, to be approximately as follows:—

	Coal.	Gas.	Mineral Oils.
Pounds of sulphur given daily in burning ...	981,792	893	743
Ratio to mineral oils as unity	1,321	1·2	1

The sulphur arising from the burning of coal is, therefore, 1,100 times that given by the combustion of gas.

Cohen and Hefford found that the distribution of the sulphur in the products of combustion of two kinds of coal was as follows in percentages of the total sulphur contained in the coal:

	A.	B.
Passing out as sulphur gases	71·78	60·
Absorbed in the soot and mainly escaping	14·51	11·88
Left behind in the ash	13·71	28·12

Mineral oils, as shown above, yield nearly the same quantity of sulphur as gas. The naphtha burnt about the streets and markets is either a distillate from coal-tar, or from petroleum; the latter may contain as much as 0·5 per cent. of sulphur (308 grains per gallon), and the former from 0·27 to 0·94 per cent. (166 to 579 grains per gallon). The refined product sold commonly as "paraffin oil" varies very much in sulphur contents, from 0·013 to 0·274 per cent.; I have found London shop-

samples at 8d. per gallon to contain 0·021 per cent., and at 10d. 0·045 per cent. (12·9 and 27·7 grains of sulphur per gallon respectively). We may conclude that hydro-carbon oils, when used for heating, contribute about the same small quantity of sulphur as gas does.

On the subject of the tarnishing of bright metallic surfaces, I found by experiments in 1903 with silver-foil, tin-plate, picture wire, curtain chains, "white metal," and electro spoons, that such articles were affected far more rapidly and deeply by the outside London atmosphere than by the air of rooms in which gas is burnt. This may be explained by the fact that the small quantities of sulphurous and sulphuric acids from the combustion of gas do not cause blackening on silver and many other metals, while sulphuretted hydrogen (which is removed from coal-gas) at once occasions it. We have seen that soot contains sulphur-compounds; Cohen and Hefford found that solid particles of soot influenced the discoloration of silver, and that when the air was filtered through cotton-wool the effect was greatly reduced. They showed also that clarified flue-gases from coal-fires blackened lead-paper, and inferred the presence of sulphuretted hydrogen.

In 1898, 35 million tons of coal were burnt per annum for domestic heating purposes out of 157 million tons of total consumption, and consequently there was no legislative control as to the smoke or acids produced from nearly one fourth of the total; five years later, the domestic consumption had fallen to 32 million tons, whilst the total consumption had risen to 167 millions, thus showing the modern tendency to replace domestic coal-consumption by improved methods of heating.

The substitution of coke for coal is only a partial remedy for the nuisance occasioned by the evolution of sulphur-acids, since the gas industry is not restricted in the sulphur-content of the coke produced.

The sulphur in coke varies enormously, and may equal or even exceed the amount in the original coal, and as in the combustion of coke no smoke is produced, the acid gases pass out unnoticed and undetected into the air. Possibly, being thus free from black, sooty and oily particles, the gases are more diffusible, quickly become dissipated into the greater volume of air, and when condensed by rain, or by contact with cold surfaces, are consequently more dilute and less harmful than the corresponding amount of acid produced from coal-consumption. It seems worth while for gas-engineers to turn their attention to this problem, as elimination of volatile sulphur from coke would considerably enhance the value of this commodity and would remove the chief objection to its extended use. Within recent years the question of the removal of sulphur-

clauses from Coal-gas Acts has been keenly debated in Parliament, notwithstanding the fact that the total amount of sulphur in coal-gas is diminished in the first place by the amount of sulphur retained in the coke, and in the second place by the universal and compulsory absorption of the sulphuretted hydrogen in the crude gas. The total amount of sulphur removed in this way from coal-gas is enormous, and makes the residual sulphur in gas, amounting to about 40 grains per 100 cubic feet, insignificant in comparison with the amount evolved in burning coke or coal, so that the relaxation of the sulphur-clauses, by reducing the cost of gas-purification and thus extending the use of gas for heating purposes, will produce the anomalous result of diminishing the sulphur-content of the atmosphere.

From experiments in 1902, and later with Mr. Hehner on a more extended scale given in evidence before a Board of Trade Committee, I found that burning coal-gas in a room does not increase the sulphur-content of the air to that reached in foggy weather in the outside air, because the water produced in the burning of the gas is far more than sufficient to absorb the sulphur-oxides, and this water condenses them on the ceilings and other basic materials present, where they become permanently fixed. A good whitewashed ceiling can thus act as an acid scrubber for many years in an ordinary gas lit room without renewal. But gas-stoves used for heating should always have a chimney, and in that case, since 95 per cent. of the sulphur is removed from the gas by purification, the sulphur-acids emitted into the air will be only a fraction of those emitted from an equivalent of burning coal.

Under the Alkali Works Act, the Legislature has already dealt with the serious pollution of air by acid gases emitted from works, and, in my opinion, these Acts ought to be extended so as to include the gases emitted from all works using coal and coke of a high sulphur-content for steam-raising purposes, without the absorption of these acids. This opinion has been held previously: in 1892 Mr. A. E. Fletcher, the then Chief Inspector under the Alkali Works Act, proposed "an Act for the Control of Noxious Gases," to be applied generally. He suggested as a definition: "a gas which is complained of, or which is notoriously a cause of complaint, or which in the opinion of the Inspector is liable to cause complaint," and thought that "the term 'Alkali Act' should no longer be used,—'*Acid* Act' would be more appropriate." Another definition proposed was "a gas which did appreciable harm to health or property."

THE DISTRIBUTION OF PRODUCER GAS AS A MEANS OF ALLEVIATING THE SMOKE NUISANCE.

By A. S. E. ACKERMANN, B.Sc.Lond., A.C.G.I., A.M.Inst.C.E.

(MEMBER.)

ANY scheme for alleviating, if not entirely removing, the smoke nuisance must necessarily be very costly in the case of London, on account of its vast size. For example, even so small a cost as one shilling per house amounts to £30,000, as there are some 600,000 houses in London, and this would go but a *very* little way towards the cost of a scheme, which, to be a complete success, must *ultimately* deal with every house, for in London the *domestic* forms 70 per cent. of the total smoke,* though one frequently hears it said that the former is of little account. We must not forget, however, what an extremely costly thing fog is to London, and how far-reaching are its evil effects. The Hon. Rollo Russell has estimated the total cost of fogs in London as over £5,000,000 per annum.† As even *one year's* cost would provide capital enough for a very large scheme, I argue that a successful (even if very costly) scheme would pay.

Dr. W. N. Shaw, in his paper just quoted, gives the following averages during the twenty years, 1881 to 1900:—

Percentage of possible duration of sunshine.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
London:—	10	15	23	31	38	36	38	39	34	24	14	9
Average for the Southern District of England:—	21	28	38	42	46	43	46	47	44	37	24	21

In Nov., Dec., Jan., and Feb. London gets *only half the sunshine that Southern England gets*, or only about 12 per cent. of the *possible* amount.

* Dr. W. N. Shaw, R. San. Inst. Congress at Manchester, 1902.

† "Smoke in relation to Fogs in London," The Smoke Abatement Society.

During May to August, when less house coal is burnt, London sunshine amounts to 84 per cent. of that in Southern England, or 37·8 per cent. of the possible. This shows a loss, due to the excess of winter smoke over summer smoke, of 34 per cent.

My proposal is that producer gas should be distributed to houses for warming and cooking and to factories for industrial purposes. This gas is made from the cheapest coal at a cost of 3½d. per 1,000 c. ft., and has a calorific value of about one quarter that of ordinary illuminating gas. 1s. 2d. worth of producer gas is equivalent to 1,000 c. ft. of ordinary gas costing 3s. The South Staffordshire Mond Gas Co. (cap. £1,000,000), having power over 123 square miles, now have some 14 miles of producer gas mains laid, and though they started to deliver gas only six months ago, the output is already 12 million c. ft. per day from the generating station at Dudley Port. This gas, however, is all used for industrial purposes, so will not decrease *domestic* smoke. The Act of Parliament under which the Company was formed does not allow them to distribute gas "for use in private dwelling houses." The price varies from 2d. to 4d. per 1,000 c. ft., or say 1s. for the heat equivalent of 1,000 c. ft. of ordinary gas, which in South Staffordshire costs 2s. 5d. per 1,000 c. ft. The minimum quantity which the Company may supply to any one customer is one million c. ft. per year, and the maximum price they may charge is 4d. per 1,000 c. ft.

Producer gas is suitable for practically all purposes for which ordinary gas can be used, except that it will *not* do for illuminating, as its flame is non-luminous and its calorific value is too low for it to be used with a mantle. The only objection that has been raised against it is that it contains about 20 per cent. of the very poisonous carbonic monoxide, but it is easy to reduce this amount. The South Staffordshire Co.'s Act does not allow more than 14 per cent. (and the gas has to have "a distinct, readily perceptible smell"), while ordinary illuminating gas, which is often enriched with water-gas, sometimes contains 12 per cent. of CO, so that the difference on that point is very small.

When I first suggested the distribution of producer gas for the purposes named some three years ago, I was not aware that it had been used for cooking and warming, though of course natural gas (which has a much higher calorific value) has been so distributed and used in America for years with signal success. I learned that the Gloucester County Asylum has used producer gas for cooking during the last twenty-two years; and that the Walthamstow Isolation Hospital has used it during the last five years for driving gas-engines, for warming the blocks of buildings, the hot

water supply, and for the whole of the cooking. The latter in December, 1903, was for 80 persons, but the same plant could easily serve 200. The cooking apparatus is arranged against two of the walls, and over it there are two wrought iron hoods which stand out 4 ft. 6 in. from the walls, and are placed 6 ft. above the floor-level. One of these was provided with an electric fan for drawing off the fumes, but very often it was found not necessary to use this. There was a slight smell of burning sulphur on entering the kitchen, and but for this it would have been impossible to tell that anything but ordinary gas was in use. The whole of the plant had, when I inspected it, been in use for two years and eight months. There had been no renewals, and they had had no trouble whatever. No headaches, no accidents. The stoves, etc., appeared exactly the same as any ordinary gas-stoves, except that the jets were slightly larger.

Producer gas is also used for cooking at the works of the following firms:—Messrs. Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees; Messrs. Brunner, Mond & Co., Ltd., Winnington; and The Co-operative Wholesale Society, Irlam.

One very important point, as it would greatly reduce the cost of introducing producer gas warming, is that the existing open fire grates could be used without alteration, simply by the addition of a multiple Bunsen burner and hollow asbestos balls such as are used in gas-stoves using ordinary gas. This would *not* be the most economical way of using the gas, but would probably be sufficiently so in the case of most existing grates, while new houses could be fitted with efficient gas-stoves. In either case we should have the advantage (sanitary and sentimental) of an open fire, and it is hardly necessary to point out that properly designed and fitted gas-stoves are quite as wholesome as coal-fires. Unfortunately, there are many gas-stoves on the market which are poorly designed and far from efficient, and which when fixed either have no chimney at all, or a very unsatisfactory one. It is such stoves and statements which gave gas a bad name for warming some years ago and have done much harm by retarding its use, though it must be admitted that with gas at 3s. per 1,000 cubic feet, the cost is too much where *constant* fires are wanted.

The advantages of gas warming and cooking as compared with coal are:—1. Greater convenience. 2. Cleanliness. 3. Labour saving. 4. Economy (especially if producer gas be used).

Under these four headings we have:—

1. The fire is started in a moment and very soon reaches its maximum temperature, whereas a coal-fire takes very much longer to do this.

2. When done with, the fire can be put out at once, so that there is no waste of fuel in the fire "burning itself out."

3. There is no heavy and dirty coal to be handled.

4. There are no ashes and cinders to be removed, the removal of which causes much dust in the room.

5. There are no grates to clean, except very occasionally.

Items 3, 4, and 5 are very important to the housewife, especially when she is without a servant.

6. The temperature can be regulated to a nicety.

7. There is less danger of fire.

8. No space is required for the storage of coal, either in the cellar, or in the rooms in which the fires are wanted.

9. The quantity of gas used is very conveniently measured by a meter, and can be easily checked by the user, whereas not one householder in a thousand checks the weight of coal supplied to him, because of the time and difficulty of so doing.

10. Gas cannot be stolen as easily as coal.

11. Lastly, and certainly not the least advantage, especially in the eyes of such a meeting as this, there is *no smoke!*

As to whether the central station for generating the gas should be in the town or close to the coalfields would depend on circumstances. There are certainly very many advantages in having the station by the coal-fields, as it would save a great amount of the costly handling and freight of the coal, and the difference in the cost of the dearer site for the station in the town.

It has been objected that the volume of gas would be so great that the mains would have to be excessively large. Fortunately gas is compressible. The pressure at which ordinary gas is distributed is equal to about 3 inches of water, which is equal to 0·108 lb. per square inch (above atmospheric pressure), while in America they are distributing gas at a pressure of 20, and even 80 lb. per square inch (above atmospheric pressure). The volume of a gas is inversely proportional to its absolute pressure, so that in increasing the pressure from 0·108 lb. to 20 lb. per sq. in. (both by gauge) the volume is reduced to *one-half*, and if the final pressure be 80 lb. per square inch, then the final volume is less than *one-sixth* that of the initial.

Another bogey is that the leakage would be great. This is not found to be so in practice. Professor F. W. Burstall stated in evidence before the recent Royal Commission on Coal Supplies that the leakage from the

Paris air-mains (in which the pressure is 100 lb. per square inch) is only 0·4 per cent. per mile, and that the efficiency of transmission is considerably better than in the case of electricity! In addition to this we have had many years of experience of the distribution of ordinary gas.

The Hon. Rollo Russell has proposed that a tax should be put on all houses producing much smoke, in the same way that factory owners are now fined. If the money so collected were used for the producer gas scheme, people would be provided with the means of avoiding the making of smoke and thus of avoiding the tax, while those indifferent to the interests of the community would rightly have to pay. New York has long since taken the far more drastic step of prohibiting the use of any but anthracite (smokeless) coal, and is rewarded with a practically smokeless city.

SMOKE PREVENTION AND COAL CONSERVATION.

By ARTHUR J. MARTIN, Assoc.M.Inst.C.E.

(MEMBER.)

SMOKY fogs involve (1) loss of light, entailing large expenditure on artificial light, estimated, in *The St. James's Gazette* of 14th October, 1903, at not less than £7,000 per day; (2) expense from disorganisation of traffic; (3) damage to buildings, decorations, and property of all kinds* †; (4) loss of life‡; during the winter fog of 1879–1880, the deaths were several thousands above the normal, the percentage increases being asthma 43, bronchitis 331, whooping-cough 231; in the last fortnight of 1891, including the 100-hour fog of Christmas, the excess above the normal was given by Dr. Vivian Poore as 1,442; (5) injury to health and impaired vitality.

In Paris or Berlin, or any other metropolis on the Continent, and in New York, prolonged black fogs, such as we have learnt to dread each recurring winter, do not occur, and the secret of this immunity lies chiefly in the difference between their modes of heating and our own.

The "Coal Tables" issued by order of the House of Commons in 1904 give the weight of coal consumed in the Metropolitan Police District during 1903 as over fifteen million tons. On a moderate computation the daily mid-winter consumption is probably not less than one-and-a-third times the average, or say 1,135 pounds per acre per day.

Every pound of coal requires for its complete combustion at least 140 cubic feet of air. Fortunately the products of combustion, which

* The Hon. Rollo Russell has estimated the annual cost of fogs in London at from three to five million pounds. *Journ. R. San. I.*, Vol. XXIII., p. 330.

† Chief Smoke-Inspector Adams, of Chicago, in a report to the Board of Health of that city, says: "I know of an instance in which a restaurant firm so consumed $600 worth of coal as to cause an actual damage to adjacent property exceeding $25,000."—*Engineering Magazine*, August 1897, p. 796.

‡ *Vide* Sir James Crichton-Browne, *Journ. R. San. I.*, Vol. XXIII., p. 209.

amount to some 5,000,000 tons per week, owing to their warmth and consequent lightness, pass upward, and under favourable circumstances are dissipated by the air-currents. During a black fog, however, as both eye and nose can testify, large quantities of these products drop back to the earth.

Dr. W. J. Russell, F.R.S., systematically recorded the amount of carbonic acid gas in the air of an open space at St. Bartholomew's Hospital from 1882 to 1884. In the absence of fogs, the average CO_2 was 4·03 parts in 10,000, with a minimum of 3 parts. Black fogs were accompanied by a marked increase, the average of twenty-nine fog observations giving 7·2 parts, with a maximum of 14·1. He pointed out the significance of the increase of CO_2 as indicating the presence of more dangerous impurities, and showed that during fogs the air contains appreciable quantities of sulphuric acid, formed from the sulphur in the coal, while hydrochloric acid is also found, to a slightly less extent, and that these acids play an important part in the production of fog.

It is believed that the solid constituents of smoke rarely rise more than a hundred yards from the ground, to which a large proportion of them eventually return. At Glasgow,* in 1904, it was found that over a ton of smut was deposited annually per acre after a week of fog. Sir W. Thiselton Dyer found a tarry deposit on the Kew Gardens green-houses at the rate of six tons to the square mile.†

These and other facts lead unmistakably to the conclusion that the fog nuisance is largely due to the practice of burning bituminous coal. Our Statute of 1273, which made the consumption of "sea-cole" in London a penal offence, long since has been repealed, but New York to-day prohibits the domestic consumption of bituminous coal within the city-limits.

It ought not to be difficult, by means of educational work such as that carried on by the Coal Smoke Abatement Society, to build up a public opinion which would call for legislation to deal effectively with this matter, New York and other American cities have shown how adequate fines can stamp out the burning of soft coal in private houses.

It is probable, however, that the desired result might be brought about with less friction in a different way. Dr. Shaw proposes to discriminate in the rating of properties between those occupiers who void their smoke into the air and those who do not;‡ but differentiation, while practicable

* *Journ. R. San. Inst.*, Vol. XXV., p. 673. † Ib., Vol. XXIII., p. 324. ‡ Ib., p. 332.

as regards factories, would be difficult and invidious in the case of private houses, unless the line of demarcation were such that it could not be easily evaded or obscured. Such a line fortunately exists, namely that between those premises which are fitted for the combustion of solid fuel and those in which no such fuel is or can be burnt. Dr. Shaw* suggests a parallelism between the smoke-problem and the sewage-problem. As London expends £211,000 per annum for the disposal of its liquid refuse, he asks whether a like sum would be too much to pay for the prevention of aërial pollution. But in dealing with sewage a large expenditure is necessary for sewers, pumping stations and purification works, while for the prevention of smoke no such system of public works is required, and it lies with each householder to eliminate the nuisance so far as his own premises are concerned. The benefit from the disuse of solid fuel does not stop at the resultant gain in the purity of the air, for an important reduction would follow in the cost of dust-collection and disposal. Taking this saving also into account, the municipalities could well afford to remit, say, threepence in the pound from the rates of those whose premises emit no smoke to fill the air and send out no solid products of combustion into the streets.

Pittsburg supplies a notable instance of such a revolution. Its furnaces and domestic stoves formerly burnt bituminous coal, with the result that it was universally known as "The Smoky City." As soon as natural gas from the oil-fields took the place of coal, there was an immediate and marked reduction in the characteristic from which the city derived its sobriquet.† But this natural gas costs about one fifth of the price of gas in London.

If we prefer the radiant heat of an open fire to the use of air as a medium for the conveyance of heat by conduction, as in steam-heating or central stoves, we must substitute for the wasteful and smoke-producing coal fire, a more rational and economical system of utilising the fuel.

The key to the solution of the smoke problem lies then in the supply of cheap gas for cooking and heating purposes; and several varieties are obtainable, as indicated in the following table. The last column shows the cost of the quantity required to give the same amount of heat as a thousand feet of coal-gas, yielding 617 British thermal units per cubic foot. The prices of some of the fuel gases do not cover distribution.

* *Journ. R. San. Inst.*, Vol. XXIII., p. 319.

† "The Oil and Gas Wells of Pennsylvania." Andrew Carnegie. Macmillan's Magazine. Jan. 1885.

Comparative Table of Gases.

	Heating value per cu. ft. B.T.U.	Cost per 1,000 cu. ft.	Quantity equivalent to 1,000 cu. ft. of coal gas. cu. ft.	Cost of equivalent quantity.
London coal gas	617	2s. 0d. to 3s. 0d.	—	— —
Dowson gas	160	0s. 1½d. to 0s. 2½d.	3,856	5¾d. to 9⅝d.
Mond gas	144	0s. 2d. to 0s. 4d.	4,285	8½d. to 17⅛d.
Blue water gas	328	0s. 4½d. to 0s. 5d.	1,884	7⅝d. to 9½d.
Dynamic gas	150	— —	—	— —
	per lb.	per ton.		
Coal	14,000	20s.	44 lbs.	4¾d.

The calorific value of ordinary coal is therefore six or seven times that of a quantity of coal-gas of the same monetary value, but this advantage is neutralised by the facts that (1) the proportion of the heat which can be turned to account is far less with coal than with gas, and (2) that coal must generally be kept burning for a much longer time than it is actually required. In power production these points are very important. In electric lighting the maximum power is sometimes required only for an hour or two in the whole day, and it is often cheaper to carry the peak of the load by means of a gas-engine than to keep extra boilers under steam for a period necessarily much longer.

Adding to the cost of fuel gas a fair allowance for the gas company's profit and cost of distribution, it is evident that such a gas could be supplied to London, with profit to the purveyors and benefit to the community. It would, however, require a new service of pipes, and before any alternative supply is introduced it will be worth while to enquire whether that which is already in the field can be made to meet our requirements.

Mr. Orme Masson, in his article on Smoke,* estimates that gas, to compete successfully with coal, should cost not more than 1s., or at most 1s. 6d. per thousand cubic feet.

Prof. Vivian Lewes, in his third Cantor Lecture on "The future of Coal Gas and Allied Illuminants," says that "directly it becomes possible to reduce the price of the gas to about 2s. per thousand," its utilization for cooking, heating and power "will become extremely rapid." In the second lecture he gives the present cost of coal-gas, delivered in the holder in large works, at 1s. per thousand, and that of a mixed gas which he proposes, of 14 c.p. and a calorific value of 500 B.T.U., at something

* Enc. Brit., Vol. xxii., p. 179.

over 9d. per thousand. In Widnes, ordinary enriched coal-gas of 18 c.p., and 650 B.T.U., is actually sold at 1s. 2d. per thousand for lighting, and at 1s. for heating and power. A witness before The Royal Commission on Coal Supplies stated that "you can get a thousand cubic feet of gas for 6d. if you take it away" from the gasworks. I believe the lowest cost at which coal-gas has yet been produced (as a by-product in a large chemical works) is 1d. per thousand c. ft. of 14 c.p. and 500 to 600 B.T.U.* In the development of the by-products of gas manufacture lies one possibility of cheapening the gas.

The last half-yearly report of the Gas Light and Coke Company shows the price of each thousand c. f. of gas sold to be made up roughly as follows:—

	s.	d.	s.	d.
Coal and oil	1	3½		
Wages and salaries	0	3½		
Purification	0	1		
Repairs and maintenance	0	4		
			2	0
Less received for residuals ...			0	8½
Net cost of manufacture ...			1	3½
Distribution	0	4		
Rent, rates, and taxes	0	3½		
Management	0	1		
Sundries	0	1		
			0	9½
			2	1
Less Sundry receipts			0	1
			2	0
Gross profit			0	11½
			2	11½

The heaviest item is coal, of which a million tons were used during the half-year, costing 13s. 4d. per ton, of which probably one-half represents the cost of carriage from the collieries. Each ton yields about 10,000 cubic feet of gas. The carriage of the coal thus accounts for one-half of the net manufacturing cost of the gas.

Turning from gas-coal to the general supply, the cost of conveyance

* Bowman on "Power Gas," Inst. Electrical Engineers, March 16, 1905.

from the colliery to the dock adds at least 1s.* The average value at the pit's mouth of the whole of the coal raised in the United Kingdom in 1903 is given in the "Coal Tables" for that year as 7s. 8d. per ton, while the average price paid by the consumer in London is about 20s., the difference amounting to £9,000,000 per annum.

It has been attempted to save this expense by power-transmission and distribution. In 1892, Mr. B. H. Thwaite proposed to generate electrical energy in the colliery-districts, and to transmit it by cable to the Metropolis and other centres.† Compressed air, which has been in successful operation in Paris since 1870, is another possible medium, but, so far as I am aware, 100 miles is the greatest distance over which it has been proposed to convey it. An alternative method, possessing some very important practical advantages, is the transmission of potential energy in the form of gas.

The prevention of smoke is not the only argument in favour of power-transmission, its main advantages being of an economic nature. The chief of these is the avoidance of the waste due to our present inefficient modes of using coal. An important corollary is the husbanding of our national coal resources.

The following table, by Mr. George T. Beilby, shows the yearly consumption of coal in the United Kingdom, and the saving which may be effected in each of its various uses.

Coal Consumption and Economy.‡

	Consumption in Millions of Tons.	Saving in Millions of Tons.	Means of Economy.
Railways	12 to 14	... 5 to 7	Gas Generators and Engines, and Electric Motors and Electric Traction.
Steamers	6 „ 8	... —	
Factories	40 „ 45	... 20 „ 30	
Mines	10 „ 12	... 5 „ 7	
Blast furnaces	16 „ 18	... 2 „ 3	Gas Engines and Recovery Ovens.
Iron and Steel	10 „ 12	... 2 „ 3	
Other metals	1 „ 2	... —	—
Brickworks, Potteries, Glass works, Chemical works	4 „ 6	... 1 „ 2	Gas Generators and Coke.
Gas works	14 „ 15	... —	Gas-cooking and Heating Briquettes, and Coke.
Domestic fires	30 „ 36	... 5 „ 8	
	143 „ 168	40 „ 60	

The importance of these savings is not measured merely by the

* Royal Commission on Coal Supplies, 2nd Rep., Vol. II., Ans. 11,935.
† *Engineer*, 2nd December, 1892.
‡ Royal Commission on Coal Supplies. 2nd Rep., Vol. II., Ans. 9,631.

reduction in consumption, since in nearly every instance this implies the supersession of wasteful and smoke-producing modes of combustion by methods which are at once efficient and smokeless.

Electrical transmission, for power-production and lighting, has many advantages; but for heating and cooking it is heavily handicapped by the enormous losses which are inevitable in the production of mechanical energy from coal. Working by steam, not more than about 12 per cent. of the heat-units yielded by coal can be recovered as heat on reconversion, while the loss in transmission and distribution would probably reduce this to under 10 per cent. Gas-transmission, on the other hand, is not only serviceable for all the above purposes, but has also the advantage that the gas is available for the production of heat with a good economy, and in a most convenient form. Another drawback of electricity is the necessity under which it labours of generating and transmitting the power at the precise rate at which it is used. The switching on of a light or motor at a remote corner of the area of supply must be responded to on the instant by a corresponding increase in the power put forth by the generator, as an electrical accumulator, commercially available on the scale required to be of much value in equalising the work of a large generating station, is not yet in sight. The plant must therefore be capable of working at three or four times the average rate of demand, with a corresponding increase in the initial outlay. These considerations apply with almost equal force to transmission by compressed air. But gas can be stored more cheaply and conveniently than any other vehicle for the conveyance of energy, and the storage involves practically no loss, whereas an electrical accumulator, under the best conditions, will not give back more than about 80 per cent. of the power delivered to it. The storage of gas enables the compressing plant to be stopped at any time without interrupting the service.

The idea of gas-transmission first presented itself to me during the latter part of 1893. I was led up to it by the reflection that if it paid to transmit power by means of compressed air under the conditions met with in Paris, it must of necessity be still more advantageous to do so by means of gas, seeing that a cubic foot of the latter would yield forty times as much energy as the same volume of air compressed to say six atmospheres, and that with gas the whole power of the compressors would be available for the transmission, as against say 10 or 20 per cent. with air. An exhaustive series of calculations relating to the thermal and engineering sides of the scheme left no doubt as to its feasibility and advantages. In this research I was, however, anticipated by Prof. Unwin, F.R.S.*

* Prof. W. Cawthorne Unwin, "Howard Lectures," on "The Development and Transmission of Power from Central Stations," pp. 6, 7.

Power-transmission on a large scale from the collieries not only avoids expense and waste in conveying, handling and distributing coal, but also admits of economy in quantity and quality of fuel. The consumption of coal by small steam-plants in Birmingham ranged from 8·5 to 36 lbs. per ind. h.p. per hour, and in electric generating stations it is rarely as low as 3·30 lbs.; while with larger engines it may be as low as 1·3 lbs.,* and with modern gas-engines has even been reduced to 0·768 lbs.†

Generating plant at the collieries can use cheaper grades of coal, not excluding the dust. About 24,000,000 tons of small coal are left as waste every year at the pit's mouth, besides an enormous quantity which is thrown into disused workings. By far the greater part of this is in no way inferior in calorific value to that sent away for sale.

The following are instances of long-distance *electrical transmission* on a large scale:—

Place.	Distance Miles.	Horse Power.	Volts.
Michoacan and Guanajuato, Mexico ‡	100	2,250	60,000
Cenischia, Italy §	38	5,600	30,000
Ogden Canon, Utah ‖	38	5,000	16,100
Cauvery Falls, India ¶	93	7,000	30,000
Yuba Falls, California ¶	222 (and temporarily 270)	15,000	40,000

All these have very high tensions and bare overhead conductors, which it would probably not be possible to employ in this country. Insulated underground conductors increase enormously the cost of the line, and the working potential has to be very much lower. Mr. H. F. Parshall ** gives 20,000 volts as the present safe limit for underground cables, which means either a large increase in the amount of copper employed, or a greatly increased loss in transmission. Moreover, in all the cases cited, the current was generated by water-power, so that the above distances afford no criterion of those over which the transmission of electrical power from coal is commercially possible in this country.

Compressed air has been much less used for long-distance work, the Paris plant, conveying power four or five miles, being probably the largest as yet laid down. In connection with the utilisation of the water-

* Prof. W. Cawthorne Unwin, "Howard Lectures," on "The Development and Transmission of Power from Central Stations," pp. 6, 7.

† Dr. F. H. Bowman, Lecture on "Power Gas." ‡ Proceedings, Inst.C.E., Vol. CLIX., p. 443.

§ *Engineering Magazine*, June, 1903, p. 362. ‖ Ibid., May, 1899, p. 313.

¶ *Cassier's Magazine*, April, 1903. ** *Engineering*, 16th June, 1899.

power at Niagara Falls, it was calculated that by air compression 5,000 h.p. could be transmitted upwards of twenty miles, with a loss not exceeding twelve per cent.

Prof. H. Haupt, Consulting Engineer of the General Compressed Air Co. of New York City, calculates that power-transmission by air, compressed by a turbine-driven plant to an initial pressure of 2,000 lbs. per sq. in., to a distance of 100 miles, shows a slight advantage in cost over steam power generated locally, and concludes that if power should be generated at the coal-mines from costless refuse coal, and transmitted 100 miles in pipes, the cost for 2,500 h.p. would be:—interest, repairs, and depreciation of the boiler plant, $9,375; wages of firemen, $2,700; of engineers, $4,000; interest and repairs on compressor plant, $12,000; interest on pipe-line, $15,000; total, $43,075, or $17 per h.p. per annum, which is nearly $10 less than the cost of steam-power generated locally.*

In *gas-transmission*, except for the ordinary city-supplies, some of which are piped to very respectable distances, little has yet been accomplished. Proposals were made to the Royal Commission on Coal Supplies by Mr. Beilby, (9,563), Prof. Burstall (10,495–7), and Mr. R. Threifall, F.R.S. (14,188). The most notable undertaking is that of the South Staffordshire Mond Gas (Power and Heating) Co., formed to supply an area of 163 square miles, between Birmingham and Wolverhampton. Their charge is from 4d. to 2½d. per thousand c. ft., or lower for quantities exceeding 5,000,000 feet per quarter. Their 4,285 c. ft. of gas at 140 to 148 B.T.U., costing from 1s. 5d. to 10¾d., are equivalent to 1,000 feet of coal gas, worth, in the district, 2s. 5d. Mond gas will probably be extensively supplied for consumption within a moderate distance of the generating station, but its low calorific value and the large quantity consequently required militate against its adoption for long-distance transmission. The same applies to producer and Dowson gas, and in less degree to blue water-gas, with its 328 heat-units per c. ft. The much greater calorific value of ordinary coal-gas renders it peculiarly suitable for this purpose, and outweighs its greater cost, due in great measure to the exacting requirements to which it has to conform, which, reasonable enough with the old-fashioned burners, are needless with incandescent mantles, and out of place for heating, or generation of power. An agitation for the abolition of these restrictions has been on foot for some years, and the hardship of having to pay for "enrichments" which are of no use cannot be perpetuated much longer. The following calculations are

* *Engineering Magazine*, July, 1895, p. 770.

based on the generation of coal-gas at the pit's mouth, and its transmission under pressure to wherever it is required for use.

A Pipe Line to Supply all Fuel Used in London.

Case I.—I assume that it is required to generate gas in the Yorkshire coalfields and pipe it to London, a distance by rail of about 173 miles, in sufficient quantity to take the place of all the coal consumed there on a winter day. The calorific value of one day's coal, taken at 55,115 tons, at 14,000 British Thermal units per pound, is about $1\frac{3}{4}$ billion units (1,729,000,000,000 B.T.U.). With coal-gas at 617 B.T.U. per c. ft., the volume required (at atmospheric pressure) will be 2,802 million c. ft. per day. A single line of 6 ft. pipe will deliver rather more than this quantity of gas with an initial pressure of 480 lbs. per square inch. If welded steel pipes are used, the total weight of steel required will be about 270,000 tons. The longest steel pipe line of which I have reliable data is one 352 miles in length for the supply of water to Coolgardie (see last session's Proceedings, Inst.C.E.). The total cost, with all charges, was £1,870,000, equal to £5,312 per mile, or £28 per ton. In this country £28 per ton would probably cover all expenses, and 270,000 tons at £28 = £7,560,000.

To compress 1,946,000 c.f.m. down to 480 pounds per sq. in. requires about 439,300 effective h.p., or, allowing a total efficiency of 77 per cent.,* 570,500 indicated h.p. If the whole were used in large gas-engines, these would develop about 9,000,000 indicated horse power. The power expended in transmission is thus under six per cent. of the whole. In electrical transmission the loss would probably be from twenty to thirty per cent.

Case II.—The foregoing case proves that a single line of pipe six feet in diameter is capable of doing the work of the 550 † coal trains required to carry to London the coal burnt there on a single winter's day, and (in conjunction with the existing distributing mains) of the horses, carts, and men to bring it from the rail to our cellars. It would not be prudent to entrust the whole supply to a single pipe line, or even to a single route, and at the present time it would be difficult to obtain 6-ft. steel pipes of the thicknesses required to withstand the heavier pressures. Moreover, it would not be economical to use pipes of the same diameter throughout, since the high velocities towards the point of delivery would cause that part of the main to absorb far more than its due proportion of

* Unwin. Proceedings Inst.C.E., Vol. CV.

† Allowing 100 tons per train (R. C., 11529).

the pressure available for transmission. A more advantageous arrangement would be to lay down four lines of pipe, each ranging from 36 inches in diameter at the coalfield to 72 inches at the London end, and capable of conveying a maximum daily volume (at atmospheric pressure) of about 700,000,000 c. ft., with an initial gauge pressure of 510 lbs. The weight of the four lines would be about 320,000 tons, or less than 20 per cent. greater than that of the less economically arranged 72-in. pipe.

To work the compressors 148,710 indicated h.p. would be required for each line, or 594,840 h.p. in all. If power had to be generated specially for compressing the gas, the most economical plant, from a fuel point of view, would consist of producers and gas-engines, in which an indicated horse power might be obtained for about 0·8 lb. of coal per hour. At this rate a compressing plant capable of working the four lines to their full capacity would consume 5,200 tons of coal per day, which is probably not far off what would be required for 550 locomotives hauling London's daily quantum of coal, and the shunting engines in the yards. There happens, however, to be a source of power already available, in the gases of combustion from the coke which is burnt for the purpose of carbonising the coal. These gases pass off from the retort ovens at a very high temperature, and if, instead of going to waste, they are passed through suitable boilers, enough steam can be raised by their means to work the compressors, thus obviating the need for more fuel. In addition to the heat thus available in the gases of combustion, a further supply is stored in the coke derived from the coal which is carbonised in the retorts. This heat is generally wasted by the quenching of the coke with water; but M. Emile Gobbe has recently invented a method for its recovery. This consists in feeding the incandescent coke as it comes from the retorts into a vertical producer, called a "quenching" producer, into the base of which a spray of water or jet of steam is led. This quenches the coke, the heat from which dissociates the steam, the oxygen combining with a portion of the carbon to form carbon monoxide, and the hydrogen being left in the free state. The heat of the coke is thus utilised for the production of water-gas, yielding a practically costless but valuable fuel, which can be used either for raising the coal from the pits, for compressing air to work the machinery below ground, or for heating the retorts, thus saving an equivalent amount of coal or coke. The steam required for working the gas compressors being thus furnished by the manufacture of the gas, we have only to take account at the power station of the engine-room costs and that of management, which for such large installations as we are now considering, and for absolutely steady work, might be taken for present purposes at 20s. per indicated h.p.

per annum. The average daily load being three-fourths of the maximum, the power consumed will be reduced in a somewhat greater proportion, but taking it at three-fourths it will amount to 446,130 indicated h.p.

The first cost and working expenses of the transmission-plant will then be as follows:—

First Cost of Transmission Plant.

Boilers, engines, compressors, and auxiliary plant	594,840 I.H.P.		
Add reserve 20 %	118,968		£
	713,808	@ £14	9,993,312
Pipe-line, including all costs, 320,000 tons ...		@ £28	8,960,000
			£18,953,312

Say £19,000,000

Annual Cost of Transmission.

	£
Wages and management, etc., 446,130 I.H.P. at say 20/-	446,130
Inspecting and painting pipe-lines when necessary, say...	20,000
Rates, taxes, and insurance, say	33,870
	500,000
Interest on investment at 4 %	760,000
Depreciation on buildings and steam plant, at 7½ %, say	750,000
Depreciation on pipe-line, at 4 % ... ... say	360,000
	£2,370,000

This is only just over two-fifths of the bare railway-charges for carrying an equivalent amount of coal to London by rail, or one quarter of the difference between the value of the coal at the pit's mouth and as delivered to the consumer. Spread over the gas transmitted, the cost of transmission works out at three farthings per thousand cubic feet.

A Pipe Line to Supply The Gas Light and Coke Co.

Case III.—This Company made during the first half of 1905 11,283,976 thousand c. ft. of gas, the maximum daily consumption being say 125,000,000 c. ft. This quantity could be conveyed from the coal-fields by a main ranging from 18 in. to 36 in. diam., weighing 25,000 tons, and worked under an initial pressure of 510 pounds per sq. in. In

this main one ton of steel is required for each 5,000 c.f. of gas carried per day, as against 8,750 c.f. in the last case. The cost of transmission per thousand c.f. would therefore be a shade higher than in Case II., but would still be under a penny.

In the foregoing no account has been taken of leakage. In the Gas Light and Coke Co.'s system 6·2 per cent. of the gas made is unaccounted for, through losses in the works themselves and in the mains and service pipes. The leakage from a system of gas-mains, of varying ages and conditions, tapped at short intervals and connected with a ramification of pipes, good, bad, and indifferent, affords no criterion applicable to a new main not used for distribution. The best of the Paris air-mains lost in each mile 0·38 per cent. of the amount delivered; but Professor Riedler believes that in newer and better laid mains the leakage is considerably reduced.* At Offenbach, under a pressure of 6¾ atmospheres, the loss was only 1·6 c. f. per mile per hour.† A loss even at the rate of 0·38 per cent. per mile would obviously be a very serious matter on a 173 mile line, amounting as it would to two thirds of the gas delivered, or two fifths of that sent out. Steel tube makers, however, are prepared to lay pipe-lines which will be practically gas-tight; and Prof. W. B. Burstall, considers that the leakage from long pressure mains can be reduced to considerably less than one-tenth per cent. per mile.‡ This over a 173-mile line would amount to 17·3 per cent. of the gas delivered, and, spreading the cost of the gas thus lost over that sold, the price of the latter would be correspondingly raised. The monetary loss by leakage of gas would probably not exceed that by waste of coal in transit and handling, and its deterioration for gas-making purposes by lapse of time.

In the foregoing statements no credit is taken for the possibility of using small coal, worth from 3s. to 4s. per ton,§ or less, or for the immense heaps of waste coal which might also be brought into use. It might, however, be better to hold this material in reserve for emergencies, in order to prevent those disastrous fluctuations in price to which coal is subject. In 1900 and 1901, for instance, the value of coal at the pit's mouth rose from 7s. 7d. per ton (in 1899) to 10s. 9¾d. and 19s. 4½d. respectively.

A saving in the manufacture of gas would be brought about by modern works erected on an ample site, and the configuration of the ground at most collieries will permit of arranging the plant much more advan-

* Unwin—Distribution of Power by Compressed Air. Proc.Inst.C.E. Vol. CV.

† Unwin—Howard Lecture on The Development and Transmission of Power, p. 65.

‡ Royal Commission, 10,495. § Ibid., 14,811.

tageously than is possible on the flat sites in and around the metropolis. A close calculation of the saving which may be expected to result from the transfer of the manufacture of gas from London to the coalfields could not safely be made without much fuller data than I at present possess, but I have shown that there is a fair probability that the light and heat which we require can be brought to us for a fraction of the £9,000,000 a year (over and above the value of the coal) which we have to pay for its carriage and handling. That something like three quarters of this can be saved appears to be beyond doubt.

As to the effect which the change will have on the selling-price of gas in London, if it were merely a question of railway versus pipe, the saving might be arrived at by deducting from the present price the difference in cost of the two modes of transmission, less the interest on the capital cost of the new manufacturing plant at the collieries. Other considerations affecting the result are the possibility of using a cheaper grade of coal at the collieries, the saving in labour due to up-to-date plant with ample space, the difference, one way or the other, between the rate of wages in London and that in the collieries, and the abolition of standards of illuminating value. It is probably not too sanguine to expect that gas will be delivered to the compressors at 6d. or at most 8d. per thousand cubic feet, as against 5·84d., the actual net cost of manufacture and distribution at Widnes. If this expectation is borne out, the gas will be delivered at the Companies' works in London at 8d. or 10d. per thousand cubic feet, which will admit of its being retailed to the consumer at a price considerably below the present. This forecast is put forward with diffidence, and may be superseded by more reliable estimates.

But the customer must not expect to receive in his gas the same calorific value as he now gets in his coal. If this were attempted, the result would be disastrous for coal-conservation, since close on five tons of coal would have to be carbonised to furnish gas equal in heating value to one ton. The volume of this gas would be about 50,000 cubic feet, and to compete in heating value with coal at 23s. it would have to be sold at 5½d. per thousand cubic feet, which is not within the bounds of probability. The saving point is that for all domestic purposes a far larger proportion of the heat can be turned to useful account with gas than with coke or coal. Hence the estimates, which have already been quoted, that gas at 1s. or 1s. 6d. per thousand cubic feet is cheaper to use than coal at current prices.

In power-production also the same applies, as will be seen from the following statement, showing the cost per Board of Trade unit of the

fuel used by the twenty-five Metropolitan Electric Light undertakings during twelve months, and the price at which gas must be supplied to enable them to obtain the same power by means of gas engines at the same cost for fuel, on the basis of 22·6 c.f. of gas per unit generated, and 115 units generated for each 100 units sold.

	Cost of Fuel per Board of Trade unit sold.*		Equivalent price of gas per 1,000 c.f.
Highest cost of fuel (Islington)	1·03	...	3s. 4d.
Lowest cost of fuel (Hackney)	0·32	...	1s. 0½d.
Average cost at 25 works ...	0·65	...	2s. 1d.

Thus coal-gas at 1s. per 1,000 cubic feet would be a cheaper fuel than coal for every generating station in the metropolis.

The gain to the atmosphere of London would therefore be twofold, owing, firstly, to the greatly reduced consumption of fuel brought about by the superior efficiency of gas as compared with coal; and, secondly, to the perfection with which that combustion would be effected.

From a coal-conservation point of view, this greater efficiency of gas is very important, for if, to do a given amount of work with gas, the same number of heat-units were necessary as in the case of coal, at least four times as much coal would be required to furnish that gas as would suffice to do the work direct. Even as it is, it is probable that the weight of coal which would have to be carbonised to supply London with gas would exceed that which is now consumed for all purposes; but as a set-off each ton of coal would yield some 13 or 14 cwt. of coke and breeze, or, allowing for the quantity required to heat the retorts, 10 or 12 cwt. available for sale. The return from these alone would be not far short of the value of the coal from which they are derived.

So valuable is coke for making pig-iron, and for foundry purposes, that of the 12 million tons which are made each year for the purpose, close on 11 million tons are produced in open ovens, with the result that the whole of the gas and other valuable residuals are lost. The removal of the gas-manufacturing industry to the coalfields would effect a great national economy, by furnishing an outlet for the utilisation of the gas from the coke ovens, and thus doing away with this appalling waste.

Any doubt which may exist as to the commercial practicability of gas-transmission will be best dispelled by a consideration of some achievements in the same direction with natural gas in the United States.

This gas (which contains practically the same constituents as our coal-gas) is obtained from deep borings in the gas districts of several States, and

* *Electrical Times*, 21st Sept., 1905, pp. 387, 389.

the greater part of it is piped to distant points. From 10 to 12 million cubic feet per day are pumped from the Indiana gas-fields to Chicago.*

Much of the gas from Northern Pennsylvania is sold in New York, and some points of consumption are more than 200 miles from the gas wells. The total production in 1903 was 238,769,067,000 c.f., equivalent in heating value to close on 12 million tons of bituminous coal. Four million people are supplied with light and fuel (for all purposes) by natural gas. The compressors which force the gas to Chicago are capable of producing a pressure of 2,000 pounds per square inch, and work at a normal pressure of 300 pounds. Several of the pipe-lines in West Virginia are from 16 inches to 20 inches in diameter.†

Hence as regards its magnitude, the number of people supplied, the distance, and the pressures, the natural gas industry of the United States affords good precedents for the project which I have outlined. The question will naturally arise whether manufactured coal-gas, with its initial cost of production, will stand the additional expense of transmission. This is conclusively answered by the fact that the average price to the consumer of natural gas in 1903 was about 15 cents per thousand c. f. If the price at the wells is taken at the extremely low figure of 3 cents, this leaves only 12 cents to cover the cost of transmission and distribution. My estimated cost of transmission, namely, 1d. per thousand c.f., added to the 4d. per thousand which it costs the Gas Light and Coke Co. to distribute their gas, gives 5d. for these two items, as against 6d. in the foregoing.

Another instance of long-distance transmission is the piping of petroleum from the oil-fields to New York harbour, over 400 miles. The main trunk line consists of three 6-inch wrought iron pipes, with twelve pumping stations some 35 miles apart. The pumps work at about 1,000 pounds per sq. in. pressure, and the capacity of the line is about 105,000 imperial gallons per day.‡ The average price of Pennsylvania petroleum was \$1·59 per barrel, or £9,540 for the day's flow, which is only a quarter of the amount of London's daily coal-bill. The annual selling-price of the maximum quantity of water delivered by the Coolgardie pipe-line is £319,375, the cost of the pipe-line and pumping stations being £2,300,000, or 7¼ years' earnings. A conduit and compressor-station to deliver sufficient gas to meet all London's requirements for fuel can be laid down for £19,000,000, only 2½ years' purchase of the saving which it would bring about.

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* "The Harnessing of Niagara," p. 348.

† U.S. Geological Survey Report. Mineral Resources of the United States, 1903.

‡ "The Harnessing of Niagara," p. 347.

In London the substitution of gaseous fuel for coal will save the army of carts which convey the coal to our houses, and would lessen the number required to remove the ashes, etc. Wherever gas under pressure can be obtained, and it will pay to lay a separate pipe, compressed gas will be available for locomotives, both on road and rail, thus paving the way for a stinkless motor. A cylinder 5½ ft. in diameter by 30 ft. long will hold, at 500 pounds pressure, enough gas to run an ordinary train for 100 miles, while the expansion of the gas could probably be utilised to cool the cylinder, thus saving a water jacket.

If the pipes are to follow new cross country lines in preference to the existing roads, it is worth considering whether the opportunity should not be taken of forming motor-roads alongside. Motorists should be prepared to pay a good proportion of the cost of new roads for their own exclusive use.

QUESTIONS OF PROCEDURE.

There is one important question remaining to be considered, namely, who are the best persons to carry out a scheme of long-distance gas transmission. So far as their own needs are concerned, the existing gas companies could appropriately lay down and work the pipe-lines. In view of the many interests involved, as for instance the companies owning the collieries, several of which could with advantage feed one pipe-line, those dealing with the residuals, the owners of the pipe-lines, and the gas companies, municipalities and private individuals drawing gas therefrom, it has occurred to me that it might be best to institute some sort of clearing house, on which all parties could be represented, and which would settle the scale of charges for the function performed by each, and deal with all disputes which might arise. Such an institution would obviate the necessity for many large transfers of property, as well as for vexatious and hampering restrictions of the right to supply.

Any piecemeal procedure involves a risk of the interests of the undertakers and those of the public being sacrificed by protracted struggles in the committee-rooms and in the law-courts, ending in compromises satisfactory to no party and irksome to all. Moreover, questions will constantly arise concerning the points on which the interests of a company may conflict, or seem to conflict, with the well-being of the public, and while any false step in the one direction may result in catastrophe, an error in the other may stifle an industry by a well-meant, but shortsighted, code of regulations. Normally, I presume, any questions of the kind would be dealt with by the Board of Trade, but in view of the present clamour

for increased attention to questions of trade and commerce, it hardly seems desirable to overload that Board with other matters. Moreover, the ground to be covered is so vast, and the technicalities so intricate, as to call for the undivided attention of a strong Board, which should have the fullest possible powers, and should deal with the technical side of all Parliamentary Bills which relate to matters within their purview.

RESOLUTION.

I therefore beg to move the following resolution, namely: That in view of the need for husbanding our coal resources, the deplorable and increasing evils produced by smoky fogs, and the desirability of providing a cheap smokeless fuel for domestic and industrial use, the Councils of The Royal Sanitary Institute and the Coal Smoke Abatement Society be asked to join in a memorial to His Majesty's Government, setting forth the urgency of these questions, and praying that His Majesty's Government will be pleased to appoint a strong permanent committee to deal with them.

[This Discussion applies to the subject before the Conference on Wednesday morning—"Domestic Smoke Abatement."]

MR. W. H. ATKIN BERRY (London) said Dr. Des Vœux had stated that coal had been used as fuel in London for the last 500 years. Macaulay had recorded in his History that King William III. had transferred his residence from London to Hampton Court, on account (amongst other things) of the smoke from the many chimneys in London which mingled with the fog. So that for over 200 years, at any rate, that state of things had been going on in the metropolis. But he (the speaker) believed that it was going to mend now that public and scientific attention is being directed to the evil and to the questions of its remedy as at the present time. He held strongly in favour of gas, both for domestic heating and cooking, and his opinion had been arrived at by experience and experiments, following upon a strong prejudice against gas fires. The great improvements effected in gas stoves during recent years had altered the conditions of the question. It must not, however, be supposed that he argued that coal was to be abandoned as hopeless in connection with the problem of smoke abatement. The Coal Smoke Abatement Society had secured abundant evidence

that the use of coal was by no means inconsistent with abatement of smoke, and had convinced them that under proper conditions and proper management the existing state of things was preventable as regards the fouling of the atmosphere with excessive smoke, and the necessary steps for preventing it should therefore be adopted. The Coal Smoke Abatement Society, in connection with H.M. Office of Works, had recently been carrying on a series of tests of grates, and although the final results have not yet been determined, satisfactory evidence had been afforded that much can be accomplished by the adoption of a proper kind of grate for coal fires.

MR. T. C. HORSFALL (Macclesfield) said that there was no doubt that a community, by the enforcement of a well devised law, could free itself in great measure from the nuisance of domestic smoke. Three years ago he had met a number of German officials who had come to England to study our experiments in housing. They told him that they had been painfully impressed in London and Birmingham by the filthiness of the air and asked him why we English do not prevent the production of smoke by house fires. When he told them that there is no law here to interfere with the making of smoke by householders, they assured him that German communities were not so helpless, and that in some German towns, of which Hanover was one, the amount of smoke made by house fires was now only about one third of that which was produced ten years ago. He knew by his own experience that domestic fires need not produce a tenth part of the smoke they now do. He heard the late Sir William Gull say that he had used an Arnott grate for twenty-five years, and regarded that kind of grate as a cure for the smoke evil so far as houses in which servants are kept are concerned. He himself had used the Arnott grate for more than twenty years, and he had formed the same opinion. The Arnott grates which he had in four rooms burnt common bituminous coal in open fireplaces and warmed his rooms very efficiently and supplied them with fresh air. The fires, half an hour after being lighted, were smokeless for the rest of the day, and if the cinders from the previous day's fire were used for lighting the fire with, no smoke was made. The flue-pipes did not need to be swept more than once in four or five years. One flue that was very much used had not been swept for seven years. He would be glad to send an Arnott grate to London to be tested by the Coal Smoke Abatement Society.

DR. ORMANDY (Warrington) said Dr. Des Vœux made a very strong point in favour of the use of gas not only for cooking, but also for heating purposes generally. One point which struck him was the impracticable nature of many of the proposals put forward. It was admitted that the greater part of the smoke issued from the innumerable chimneys of dwelling-houses, and was particularly evident in the early hours of the morning, at noon, and in the early

evening, in other words, during the cooking periods. Dr. Des Vœux rightly pointed out that a great objection of the use of gas fires in the kitchen, would be the consequent doing away with the hot water supply at present so largely arranged to work from the kitchen fire. This difficulty it was proposed should be overcome by the use of slow combustion stoves with hot water jacket. He desired to point out that the greater quantity of the smoke produced came from the innumerable thousands of small dwelling-houses. It was absurd to suppose that builders would go to an expense such as thus suggested, and still more absurd to think that the tenant would take the matter on his own shoulders. Beyond educating the public gradually to do the best with the existing facilities, the only hope for new action lay in persuading builders of new tenements to adapt these more up-to-date methods of economical and smokeless combustion. With regard to the papers of Mr. Ackermann and Mr. Martin, these both seemed to fail to realise that a tremendous amount of fuel was burnt with the object of raising steam for purposes other than that of power production. There were also very many manufacturing operations which it would be most uneconomical to carry out by means of gas firing. As regards the generation of power there is little doubt that the gradual introduction of the internal combustion engine will do much to diminish the smoke nuisance.

Mr. Marsh (Manchester) stated that as a Manchester man he could not agree that the manufacturers of that district were careless as to the sanitary condition of their surroundings, and that from his experience of them he felt sure they rather courted any criticisms than shunned them. He was delighted to think that the districts round Manchester were at present in the van of progress as regards smoke abatement. The efforts of the manufacturers to abate smoke were probably not caused by any æsthetic ideas, but from a desire to economise, it being well known where there was great smoke there was great waste. To give a proof of what was being done, he remarked that at works with which he himself was connected some 700 mixed coal and coke fires had been converted to gas fires. The stoves referred to were Timmen's stoves. There was now no trace of smoke, and a further recommendation was the greater cleanliness in the works, immunity from fire, and economy in labour of carrying away the refuse, which, in the case of so many fires in one building, is a matter of no little moment. He was of opinion that this class of stove should be adopted by the tinplate workers throughout the kingdom. Then in respect to power, he might say that the works referred to was driven entirely by gas engines. In the district of Manchester a considerable number of gas engines of large power, varying from 250 h.p. up to a thousand h.p., had recently been erected. The mills and factories were therefore doing their utmost to reduce the amount of smoke in the atmosphere, but the domestic house fire, as previous speakers had stated, was the great culprit, and he was afraid that no radical improvement would take place until these coal fires were displaced by gas fires. He was not a believer

with those who thought that restrictive laws would be of much service. Educational influences such as those exerted by Sir Wm. Richmond's society and other kindred societies have had, and are having more effect than all the laws on the statute book.

COUNCILLOR W. MUIRHEAD (Liverpool) said, in matters of smoke abatement the readers of papers had forgotten the obvious usefulness of electricity, both for motor power and for heating; the writer having found a bedroom electric radiator much superior to other methods for its purpose. In speaking of the injurious effects of smoke, the noxious fumes from gas when used either as an illuminant or for motor power must be considered. Although a certain amount of smoke might come from electric generating stations, still this was local and comparatively limited. Far more could be done by educating the people and conferring with builders and architects than by supporting such drastic legislation as that proposed in some of the papers. In many cities and most small towns the gas was not a public asset, but belonged to a private company, and until the powers of private companies were limited, more especially as to the manufacture of poisonous water gas, great care should be exercised in putting more power into their hands. As regards the use of coke it must be remembered that at the present time the supply was limited and any further great demand would enormously increase the price.

MR. B. H. THWAITE (London) said that the suggestion that broken coke from by-product recovery-coke ovens should be used instead of soft coals in grates, was the best and most immediately practicable remedy put forth; but with the proviso that in the coking of the coal for the specific purpose named, the coking operation should not be carried to the full period of exhaustion, but should be arrested at a point a little beyond that of an ordinary retort gas making process, so as to permit some proportion of the hydrocarbon to be retained with the coke to assist in its ignition, and in the maintenance of combustion. The expenditure of 8 to 10 cubic feet of gas should be ample to effect the ignition of the coke. He had seen the domestic coke and open fires in Sir Chas. Cookson's house, and could confirm his statements. There should be no difficulty in adopting this method of domestic heating if the scheme of coke and electric bulk power production, referred to in the postscript to Sir Charles Cookson's paper, is adopted,* and which would remove the smoke disgrace of London. He utterly disagreed with the *laissez faire* policy of our government, regarding the methods of arresting the production of smoke by the householders of our great cities; if this free and do as you like principle continued, there was little hope that the smoke nuisance *would ever be removed.* The suggestion in Sir George Livesey's paper that the illuminating value of town gas should be reduced

* A copy of a reprint of this article had been handed to the Secretary.

to 8 to 10 candles, he thoroughly agreed with. The reason for the high illuminating standard value, involving the use of expensive enrichers, *disappeared* when the Auer-Welsbach invention was perfected, now some 15 years ago, and the continued insistence of the present lighting standard by our authorities is unwise. The use of the low candle power gas preferably produced in by-product recuperative coke ovens, would permit the economic production of such gas, of the proposed reduced standard value of 8 to 10 candles. The coke oven combustion chambers could be fed with producer gas made from common slack coal, the coal for producing coke could be selected from coal having low sulphur-content qualities.

Mr. Ernest A. Dowson (Birmingham) said that he had read Mr. Martin's paper with much interest, and agreed with him that ordinary coal gas was more suited for general distribution over a wide area than was any kind of semi-water producer gas. The latter was in its own special field when converted into power and heat in the vicinity of the works where it was generated, rather than for transmission to great distances. As pointed out by the speaker in a recent paper read in Birmingham, the point was of *fundamental* importance in connection with the firing of large furnaces. To ensure success and the greatest economy in these cases, they should endeavour to avail themselves of the hydrocarbons, and thus obtain as much *radiant* heat as possible from the luminous flames given. Passing to the question of the warming of apartments by the direct combustion of producer gas, which was certainly a useful application of this fuel, there were one or two points which occurred to him to mention. For well-known reasons it was advisable to take more care in the use of this kind of gas; and in his opinion the stoves should be designed as far as possible to ensure that, in the event of the flames becoming unintentionally extinguished, the unconsumed gas shall pass entirely to the chimney without any escape to the apartment. For the same reason he would advise that, in every case where this gas was burnt in a small or closely confined room, a pilot-flame of ordinary coal gas should be kept alight adjacent to the nozzles in the grate. This would then ensure the automatic relighting of the fire after any temporary interruption in the supply of the producer gas. He did not wish to appear an alarmist, but it was very important to avoid getting a bad reputation for the system merely for the want of taking reasonable precautions, especially remembering that the public took a long time to educate in new methods. Although he was specially interested in the application of gaseous fuel, he nevertheless felt that there were cases where the combustion of solid fuel at the point of application would always be called for. It is thus of extreme importance, from every point of view, that furnace design shall continue to receive expert attention. A previous speaker (Mr. Councillor Muirhead) had suggested the possibilities of electrical heating, but, apart from its financial aspect, this side of the subject failed to touch the root of the matter. All

would see that they must go some steps further back, to the generating station, where they were again faced with the problems which were being discussed by the bodies under whose auspices the conference was held.

MR. THOS. POTTERTON (London) said that one of the speakers in the discussion remarked that the heating of water by gas was too expensive for ordinary use in small houses, and suggested that it could be done from a small boiler with coke as fuel. He would like to state that water for domestic use could be most economically heated from gas. With 27 ft. of gas he could obtain a bath of 20 galls. at 90° Fahr., and if a second bath was required, the gas being kept burning, 27 ft. consumption would yield a bath at 100° Fahr. It should be noted that in the first instance the apparatus was quite cold, while in the second the water was partly heated, which accounts for the difference. These figures represented winter conditions, so that in the summer the cost would be less. It would therefore be seen that for workmen's dwellings where slot meters were provided, by placing one penny in the slot a hot bath could be obtained.

DR. K. E. MARKEL (Warrington) speaking as a delegate from the "Beautiful Warrington Society," pointed out that a very important point with regard to the damage done to property by the products of combustion had not been brought forward, a point which was especially significant at the present moment, when the Charing Cross railway disaster would be fresh in their minds. The fact that the oxidised product of the sulphur in the coal condensed on surfaces and formed sulphuric acid was not generally apprehended. Nor was it sufficiently recognised that this was a progressive reaction. Yet this it was which explained the enormous damage done by comparatively small quantities of sulphuric acid in contact with iron. The sulphuric acid not only dissolved iron in the first instance, but acted afterwards as a kind of intermediary agency between air and iron, going on eating through the iron as practically no other substance would do. When polished iron was exposed to a smoky atmosphere it would be observed that after a short time the bright surface was covered with fine specks of soot, followed soon after by specks of rust, the soot thus forming centres of corrosion. The sulphurous acid originally condensed in the soot had become oxidised into sulphuric acid, and this it was which was responsible for the corrosion. As this corrosion, or conversion of iron into rust, was so important a question, he thought it worth while explaining it chemically. In the first instance on contact of sulphuric acid with iron, ferrous sulphate was formed. This ferrous sulphate took oxygen from the atmosphere and was converted to another substance called "basic ferric sulphate," which, again, in contact with iron was converted into ferrous sulphate and iron oxide or rust. The ferrous sulphate would again become oxidised in the way just described and again reduced by contact with iron, and this process would continue until the whole of the iron was eaten through. The large quantity of a million tons of sulphuric

acid, of which Dr. Rideal had spoken in his paper, afforded no measure of the damage done unless one took into consideration that important and as yet little recognised fact of the progressive action of sulphuric acid on iron. He also pointed out that if manufacturers had recognised combustion to be a purely chemical reaction enormous economies could have been effected throughout the country, together with abatement of smoke from factories. He himself had adopted a plan of placing the management of all furnaces and boiler fires in his works in the hands of chemists, with results equally astonishing whether one regarded the abolition of smoke, or the increase of furnace efficiency and boiler power. His advice to all engaged in manufactures in which combustion of fuel played a part, would be therefore, "supplement your engineer by a chemical expert."

Mr. J. Macaulay (Liverpool) said that Sir C. Cookson did not state how he would prevent the coke ash from choking the holes of the Bunsen burner which he placed under the grate, nor how he would prevent it from flying over the furniture when the fire was disturbed. Then again, there was the old nuisance of smoke if coal and wood were used to light the fire each morning in the ordinary way. The fact remained that common coke made a dirty ashy fire from which very much sulphur was given off.

MEAT INSPECTION.

By A. SHERIDAN DELÉPINE, M.B., M.Sc.

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(FELLOW.)

Read at Sessional Meeting, Manchester, February 2nd, 1906.

THE objects of food inspection are clearly indicated by several Acts of Parliament to which I will give a few references by way of introduction to the subject of meat inspection. It will be sufficient for my purpose to begin with the Public Health Act, 1875.

Public Health Act, 1875; Public Health Acts Amendment Act, 1890.

The Public Health Act, 1875, supplemented by the Public Health Acts Amendment Act, 1890, gives power to sanitary authorities to have "all articles intended for the food of man, sold or exposed for sale, or deposited in any place for the purpose of sale," inspected by their medical officer of health or inspectors. These officers may seize any article of food which is diseased, unsound or unwholesome, and take it to a magistrate who may order such articles to be destroyed, and inflict a penalty upon the offender.

The Sale of Food and Drugs Acts, 1875-1899.

The Sale of Food and Drugs Acts, 1875-1899, render the following offences punishable:—

1st. The mixing, colouring, staining, powdering with any ingredient or material, of any article of food so as to render it injurious to health.

2nd. The sale, to the prejudice of the purchaser, of any article of food which is not of the nature, substance or quality of the article demanded, or of any compound article of food which is not composed of ingredients in accordance with the demand of the purchaser.

3rd. The abstraction from any article of food of any part of it so as to affect injuriously its quality, substance or nature, or the sale of any article so altered without making disclosure of the alteration.

The Sale of Horseflesh Regulation Act, 1889.

This Act prohibits the sale of horseflesh for human food elsewhere than in a shop, stall, or place over and upon which there shall be at all times painted, posted, or placed in legible characters words indicating *that horseflesh is sold there.* Section 2 prohibits the sale of horseflesh for human food to any person who has asked to be supplied with some meat other than horseflesh, or with some compound article of food other than horseflesh.

(It had been found that horseflesh was occasionally sold as ordinary butcher's meat, and was sometimes used in the preparation of potted meat, sausages, &c., under conditions which made it difficult for the consumer to detect the fact.)

The objects of these Acts are obviously to protect the public against dangers associated with the use of diseased, unwholesome, or unsound articles of food, and to prevent the detriment caused to them by their being supplied with an article inferior in quality to, or of another kind than, the article asked for. It will be noticed that food inspection is concerned on the one hand with the prevention of disease, and on the other with the prevention of fraud.

Main Objects of Food Inspection.

The main objects of food inspection may be summed up under the five following questions, which practically cover all the points which are of interest to the sanitary authority:—

1. Does the article (generally animal) show evidence of disease, and more especially of a disease due to animal or vegetable parasites capable of infecting man?

2. Has the article become contaminated with poisonous substances, or polluted with infectious products, through imperfect keeping or preparation?

3. Has any substance possibly injurious to health been added to the article of food for purposes of preservation or for any other purpose?

4. Is the food of the nature, substance or quality demanded, or has any other substance been substituted to part or to the whole of the normal article?

5. Is the article of food (though free from infective properties, pollution, contamination, adulteration) of a nutritive value below the normal?

Meat Inspection a branch of Food Inspection.

I have to deal here only with one branch of food inspection, viz., the inspection of meat. What I have already said of inspection of food generally applies to inspection of meat in particular.

Difficulties caused by the number of Private Slaughter-houses.

It is not easy to realise fully the difficulties attending meat inspection, and, considering its importance to the public, it is remarkable that administrative measures capable of facilitating this work and of increasing its efficiency should not be generally adopted in all civilised countries. In a large town the number of animals slaughtered weekly is so very considerable that unless all the slaughtering is done in public slaughter-houses supplied with a sufficient staff of efficient inspectors it is practically impossible for all the carcases to be satisfactorily inspected, and yet private slaughter-houses are still prevalent all through the country. Urban sanitary authorities have power to provide and supervise public abattoirs or slaughter-houses. But the fact that they may also license or register slaughter-houses or knackers' yards shows that the existence of private slaughter-houses is considered a necessity (Public Health Act, 1875, and Public Health Acts Amendment Act, 1890). Moreover, in rural districts nothing actually prevents the killing of animals in unlicensed or unregistered places for purposes of sale. It is difficult to realise how the work of meat inspection could be carried out in Manchester if a great part of it were not centralised at the Water Street City Abattoirs and Carcase Market. The existence of some eighty private slaughter-houses and two or three suburban abattoirs must, however, add considerably to the task of the chief veterinary inspector and his assistants, who need to be endowed with considerable ability and industry to face their duties as successfully as they do. In small towns not provided with public abattoirs and a sufficient staff of inspectors, the difficulties are still greater; whilst in rural districts efficient inspection is practically an impossibility under the present state of things.

Meat Inspection in Manchester.

It is easy for me to show that I do not exaggerate the difficulties to which I refer, by quoting a few facts which are recorded by Mr. Holburn, the Chief Veterinary Inspector, in his report for the year 1904, which is given in Dr. Niven's report on the health of the City of Manchester for 1904 (p. 352).

Number of Animals slaughtered in Manchester during the year 1904.

	Cattle.	Sheep.	Lambs.	Calves.	Pigs.
City abattoirs, Water Street	27,415	106,176	51,139	1,627	15,769
Rusholme abattoirs	667	7,795		222	3,354
Private slaughter-houses					
Beef butchers (approximately)	8,672	40,092		...	...
Pork " "	...	...		...	21,840
Totals........................	36,754	205,202		1,849	40,963

This is a grand total of 284,768 animals, which is equivalent to saying that for every hour in the whole year, day and night, there were in 1904 about 32 animals killed.

Number of Carcases exposed for sale in the Dead Meat Market, Water Street.

	Beasts.	Sheep.	Lambs.	Calves.	Pigs.
Abattoir killed	24,551	100,049	49,365	409	2,982
Imported { Fresh	38,463	54,256	271	15,668	21,223
Imported { Chilled and frozen	14,664	185,757	39,244	565	25,036
Totals	77,678	340,062	88,880	16,642	49,241

So that in 1904 the number of carcases exposed for sale at the Water Street Meat Market alone amounted to 572,503, or, on an average, 1,568 for every day of 24 hours, which is equivalent to more than one a minute day and night.

Beast, sheep and pig offals are also imported and exposed for sale in the meat market to the following extent:—

Fresh offal	945,600 lbs.
Chilled and frozen offals	1,406,850 „

Amount of Meat Condemned in Manchester during the year 1904.

The amount of unwholesome meat condemned during the year was as follows:—

Beef	307,695 lbs.
Mutton	9,848 „
Veal	6,395 „
Pork	27,355 „
Imported offals	29,640 „

Places where Animals were Slaughtered.

Not only do all these figures show the magnitude of the task, but some of the details given indicate special difficulties.

1. It will be noticed that all the slaughtering was not done at one abattoir, and that a very material number of animals were slaughtered at private slaughter-houses.

Imported Carcases.

2. Out of 572,503 carcases exposed for sale at the Water Street Dead Meat Market, only 177,356, or less than one-third, had been

slaughtered at the adjacent abattoir, and the rest had been imported. The imported carcases were of two kinds:—

1. *Frozen and chilled carcases* from Australia, New Zealand, South America, and the United States.

2. *Fresh carcases* from Birkenhead, the Manchester Foreign Animals Wharf, the country.

Carcases from the Country.

With regard to the fresh carcases from the country, there is always a strong suspicion that the animals have been killed to prevent them dying from disease, and that every care has been taken by the butchers or farmers who dressed them to remove as far as possible every sign of disease. The inspection of such carcases is often a matter of great difficulty, for the internal organs are not usually available for inspection.

Desirability of Regulating the Slaughter of Animals in Rural Districts.

Such difficulties would not exist if the slaughter of animals at unlicensed premises were not allowed, and if carcases sent to the abattoir from the country were accompanied by some certificate or document indicating their origin and by whom they have been slaughtered. The licensing of all slaughter-houses in rural districts, and the prohibition of slaughter at the farms (except for home consumption or in the case of accidental injury), would not only prevent the sending of many diseased carcases to towns, but also check other abuses and dangers which I have pointed out in the "Memorandum on Anthrax" which I presented last year to the Cheshire County Council. It is a significant fact that out of the 234,609 pounds of meat condemned in 1904 at the abattoirs and carcase market, 179,164 pounds was dressed meat consigned from other places than the city. Out of this last quantity there was 5,600 pounds of *cattle meat* imported from the country.

Essential Difficulties of Meat Inspection.

Even if by efficient administrative measures the slaughter and the sale of carcases were centralised in well-appointed public abattoirs and meat markets, the work of meat inspection would still be attended with many difficulties. The *actual mass of material* which has to be examined in a large city is in itself an obstacle to thorough inspection, wherever the number of inspectors is insufficient and the system adopted has not been so planned as to minimise waste of time.

To the material difficulty caused by the actual number of carcases or parts of carcases which have to be inspected, must be added that caused by the necessity of adopting more or less complicated *methods of diagnosis* in order to establish the exact nature of some defects or lesions.

With regard to the latter point it might be said that a strictly scientific diagnosis is not necessary for purposes of meat inspection, and that meat which is not absolutely normal in every respect should always be rejected. If this were done there is no doubt that much valuable food would have to be destroyed arbitrarily, or else that it would be necessary to accept as sound many articles the appearance of which would not be bad enough to justify their destruction on the ground of appearances alone. Thus if all carcases showing evidence of tuberculosis, however limited, were destroyed very serious and unnecessary loss of good meat would ensue. On the other hand if, without considering the state of various parts of an animal, its flesh was passed whenever it presented a good appearance the consumer would run certain risks. In many cases it is only on the basis of an accurate knowledge of the nature of the defects which are condemned that seizure can be legally defended. It is also on the basis of a thorough knowledge of the exact nature of various lesions that it has been found possible to determine how far certain defects were or were not injurious to the consumer. Therefore, while it is possible to indicate a certain number of general appearances which are incompatible with soundness of meat, and which properly trained, intelligent and observant inspectors should be able to detect easily and rapidly, there are, on the other hand, other appearances which require for their correct interpretation a sound knowledge of animal pathology, and of various microscopical, bacteriological and chemical methods of diagnosis. I may take this opportunity of suggesting that a small laboratory should be attached to all well equipped public abattoirs for current diagnostic work not requiring lengthy investigations. Special work of this kind can only be carried out successfully by, or under the supervision of, men who have devoted several years of their life to the study of animal diseases.

Ostertag, probably the greatest authority on meat inspection (speaking of Germany), says: "It is now generally recognised that it is part of the chief functions of veterinary medicine, through the supervision of meat inspection, to protect human health against dangers which may be associated with the eating of meat."

Meat inspection has now become a separate subject of study in various countries, among which may be mentioned England, France, Germany, Austria, Switzerland, America and Japan.

In this general introduction to the subject, I cannot enter into a detailed account of the work of the meat inspector. I may, however, indicate generally how the appearances of disease or unsoundness fall under two categories.

1. The general appearances which, without necessarily indicating the existence of a special disease, show that the meat is diseased, unsound, and unfit for food.

2. The special appearances which indicate the existence of definite diseases, without necessarily proving that the meat is entirely unfit for food.

General Characters of the Parts of a Carcase.

The colour, transparency, smell, moisture, consistency, and reaction of each part give important indications as to the state of a carcase.

The various parts which usually fall under observation in a dressed carcase are the flesh or muscles, the fat, the lymphatic glands, the serous membranes, the bones and articulations. It is not necessary that I should deal here with the various general features by which the age and sex of the carcase can be determined by the means of certain anatomical features.

Time will not permit me to deal with the viscera. I will simply show here by a few examples how a systematic examination of the parts of a carcase exposed for sale may allow a careful inspector without special anatomical knowledge to recognise evidences of unsoundness. I will suppose that the carcase has not been frozen or chilled.

Muscle and Fat.

When the flesh of a slaughtered animal comes under the notice of the inspector, it is generally set, that is to say, it has passed into the state of *rigor mortis*, which may begin from a quarter of an hour to a few hours after death, and may pass off in from one day to several days. In animals which have been driven immediately before death the *rigor mortis* begins and passes off early. On the other hand, *rigor mortis* may be practically absent in animals which were suffering from septicæmia or hydræmia.

On cutting through a piece of well set beef from an adult animal, one observes that the freshly-cut muscles are of a dark red colour, which becomes rapidly brighter on exposure to air. The fat is yellowish, nearly white. Both are opaque, and should exhibit very few, if any, vessels containing blood.

Newly-set meat is dry, but after a time a small amount of muscle serum separates and causes a slight moisture of the surface, which, however, should never become actually wet.

The *smell* which is special to beef is slight and not unpleasant, and is more distinct when the tissues are warm or rapidly boiled than when they are cold. Experts are able to recognise the flesh of various animals by the smell alone, but they are liable to error.

The *consistency* of the flesh is firm, elastic, and on passing the fingers over it or squeezing it the meat does not feel wet, sticky or friable. The fat is fairly hard at the ordinary temperature and does not feel or look oily.

The *reaction* of the muscles, which is neutral at the time of death, becomes acid in from three to six hours after death, the reaction becomes alkaline after putrefaction has set in.

Age affects considerably the characters of the meat. In an old animal the flesh becomes darker and tougher on account of an increase in the proportion of fibrous tissue. The fat becomes more yellow and softer.

In *calves* the flesh is pale and the fat is not so white as in the adult. The flesh of young calves and especially immature calves contains a large amount of *glycogen*, the glycogen disappears a few weeks after birth.

Horse flesh is darker in colour than beef, it darkens rapidly on exposure to air and shows a bluish sheen after long exposure. The fat has a golden yellow or brownish-yellow colour, according to the situation; it is soft and oily, melting at a lower temperature than beef fat. The flesh contains a large proportion of *glycogen*, a fact which is taken advantage of in detecting the presence of horse's flesh in compound articles such as sausages. I need not for my purpose allude to other animals.

Serous membranes.

The pleura and peritoneum are thin membranes lining the cavities of the chest and abdomen; they should be smooth, glistening, and transparent; they should not be wet or roughened or covered with any product rendering them opaque; they should not be congested or blood-stained. Any evidence showing that they have been removed, *more especially when care has been taken to hide the fact* by smoothing and smearing the denuded surface, is an almost certain indication of disease, for *stripping* is usually adopted by butchers to hide obvious evidences of disease.

Lymphatic glands.

The inspector should always be able to find rapidly the most important lymphatic glands, for these organs furnish important information with regard to various diseases, more especially tuberculosis. They vary considerably in size, some are barely one-eighth of an inch in diameter, whilst others exceed one inch. They are normally surrounded by fat,

from which they can be easily separated; they are rounded or kidney shaped, smooth externally, on section they have a greyish-brown colour, the exposed surface is somewhat translucent and is slightly moist, but not wet; they feel firm and elastic.

Articulations and bones.

The *articular cavities* should not be distended with any kind of fluid or material. The *articular ends* of the bones should not be bulky. The *articular cartilages* should be quite smooth, bluish translucent in young animals, almost white in older animals. The *bone marrow* of long bones should be firm and yellow, not gelatinous, soft, semi-fluid, or blood-stained.

Types of diseased or unsound meat.

Having now considered the general characters of the carcase without reference to any special region of the body, we may briefly consider how these characters are altered in a few important types of diseased or unsound meat.

Immaturity.

The flesh of young calves under two or three weeks of age exhibits a pale greyish colour, is flabby, soft, easily torn, or penetrated by the finger, the fat is scanty, greyish yellow or reddish in colour. The articular extremities of the bones are bulky and not firmly connected with the shaft. The bone marrow is red and soft. According to Ostertag, calves are immature until they are eight to fourteen days old, but in many places they are not allowed to be slaughtered until they are three, four and even over six weeks old. Immature meat though not injurious is of an inferior quality, and is usually considered unfit for the market.

Emaciation and senility.

A.—*Simple physiological emaciation or poorness of meat* such as is due to old age, insufficient feeding, various states of activity such as may be observed in breeding animals, cows in active lactation, etc., is manifested by diminution in the amount of fat, and also, in old carcases, by a darker colour and an increase of toughness due to the greater proportion of fibrous tissue. Such meat, though poor, is not unwholesome and is useful for special purposes.

B.—*Emaciation with atrophy of muscles, serous infiltration, dropsy or hydræmia* may be due to old age and imperfect assimilation, or more generally to chronic disease. In such cases the muscles are atrophied, flabby, greyish red, the fat is almost entirely absent or gelatinous looking. There is often a certain amount of serous infiltration of the subcutaneous

and subserous fat, and of the fibrous tissues in the muscles. The bone marrow may be soft and red in extreme cases. Even in the absence of clear local lesions indicating a definite disease, it is obvious that such meat is unfit for food.

Dropsy and Hydræmia.

This is usually associated with emaciation, and is observed especially in sheep in connection with Distomatosis and certain forms of Strongylosis, it may also be observed in young cattle. The meat does not set properly, the muscles are greyish red and sodden looking, the fat is replaced by gelatinous looking tissue loaded with serous fluid which also infiltrates all the connective tissues; the blood is thin and pale, the meat is wet and a large amount of fluid drips from it when it is suspended. Meat of this kind is unfit for food.

Febrile diseases, choking, fatigue, etc.

Many acute or chronic febrile diseases give rise to typical localised lesions of the viscera, of the lymphatic glands, and sometimes of the muscles and bones, but apart from these characteristic lesions there are some general signs which are observed in a large majority of cases.

The muscular tissue has generally a dull grey colour, which may be replaced after a few minutes' exposure to the air by a salmon-red colour. A similar appearance may be observed in animals which have died as a result of impaction of large bodies in the œsophagus (*choked*). The flesh may exhibit a mottling indicating degeneration or may be the seat of small hæmorrhages (when the animal has died naturally the meat may have characters similar to those observed in asphyxia). The muscular tissue is soft, friable, and often sticky or gummy.

The fat is often congested, more blood than usual remains in the vessels; the surface of section of a joint appears wet, and if the joint is suspended blood generally drips from it; the lymphatic glands are frequently large and congested. The serous membranes have often lost their natural transparency and smoothness, they may be discoloured, blood-stained or the seat of hæmorrhages. Febrile meat has frequently a characteristic smell.

The flesh of *animals which have been driven* and excessively fatigued before death may present appearances which are not unlike those associated with fever, but the meat is usually darker in colour.

Asphyxia and natural death from disease.

Animals which have died of accident or disease differ from animals which have been slaughtered owing to the retention of blood in the vessels.

This is not only shown by the state of the vascular organs, but also by the dark brownish red colour of the muscles, lymphatic ganglia and bone marrow, the blood-stained appearance of the serous membrane, the network of distended blood vessels in the fat, etc. These appearances when not associated with evidences of an accident causing death by asphyxia or otherwise, almost invariably indicate that the animal has died from disease.

Jaundice.

When jaundice is well pronounced all the tissues assume a well marked yellow colour, modified by the natural colour of the tissues; this is specially observed in sheep, and renders the meat unmarketable and unfit for food. A slight yellow discoloration, often observed in the fat of well-fed animals and others, must not be mistaken for the jaundice here referred to.

Bad smelling meat.

The meat may acquire bad smells in various ways, viz., *Urinous smell* when there is extravasation of urine; the *smell of various drugs,* such as ether, chloroform, turpentine, camphor, ammonia, carbolic acid, assafœtida, etc., when these drugs have been used for the treatment of the animal before slaughter. These smells become intensified when the meat is warmed or cooked with a little water.

Decomposed Meat.

Post-mortem decomposition or putrefaction is indicated by the smell, a distinct alkaline reaction and softening of muscles, and an alteration in the colour of various tissues.

From this brief description of some of the general characters indicating disease or unsoundness of meat, it will be seen that, even without a special knowledge of disease, it is possible to recognise many states which render meat unfit for food.

Infectious Diseases.

Among specific lesions characteristic of infectious diseases such as pyæmia, anthrax, glanders, tuberculosis, actinomycosis, trichinosis, cysticercosis, and many others, there are some which are easily recognised, whilst others require the adoption of various scientific methods for their accurate diagnosis. Time does not allow me to deal with these special lesions to-night, it is not necessary that I should do so for the purpose I have in view, nor do I wish to do more than point out the importance of the examination of living animals intended for slaughter, whenever this is possible. I am, however, exhibiting some specimens, illustrating typical lesions connected with diseases which render meat unfit for the food of

man, and Mr. Holburn has been kind enough to send from the abattoir a number of fresh specimens showing several of the general changes which I have described.

Conclusions.

This brief survey shows, I think, that meat inspection is an important branch of Preventive Medicine and Public Health. The heavy work that it involves can only be carried out by energetic, diligent, well-trained men gifted with keen powers of observation. As Dr. Vacher has pointed out in his useful "Food Inspector's Handbook," thorough honesty of purpose and fairness are also indispensable qualities. Besides the work of general inspection, which well-trained inspectors can carry out without a special knowledge of Veterinary Pathology and Hygiene, there is work of organisation, administration, and special investigations, which can be carried out only by experts who have made a special study of animal diseases, and who should be supplied by municipal authorities with all the means for the rapid and thorough investigation of doubtful cases. In order to secure a very efficient system of inspection, large towns should be provided with public abattoirs and private slaughter-houses should not be tolerated. In rural districts no animal should be slaughtered for trade purposes in places not licensed and supervised by the authorities.

Mr. A. Holburn (Manchester) explained the characteristics of the various specimens which were exhibited.

Dr. Vacher (Cheshire C. C.) said, it would be difficult to exaggerate the importance of making efficient arrangements for the proper inspection of all meat intended for human food. Many changes had been made in methods of meat inspection since the speaker's attention had been first drawn to the subject in 1873. Certainly less was attempted and less accomplished at that time than at present. Medical Officers of Health then gave little attention to the matter, or none, and most inspectors had received no training to qualify them for the work. Diseases of cattle were more prevalent. The one disease which was probably less frequent thirty years ago than now is anthrax. The meat inspection problem was not difficult to solve in large towns such as London, Manchester, Liverpool, Birmingham, Bristol, Bradford, Leeds, Newcastle-on-Tyne, etc. In these towns arrangements could be made for nearly all the slaughtering being done in public abattoirs. Medical Officers of Health of experience could impress the authorities with the importance of thorough meat inspection. Veterinary surgeons with special training could be appointed for the supervision of the public abattoirs, the trade not unusually assented to the decisions of the veterinary inspectors, and even when prosecutions were

undertaken convictions were not difficult to obtain. In urban districts of less importance throughout the country the slaughtering was done largely in private slaughter-houses, and the inspection of these, not infrequently, had to be done by inspectors who had little knowledge of the work, and no liking for it. It was, however, in rural districts that the greatest difficulty obtained as regards meat inspection. Slaughter-houses were put up in out of the way places, and the authority, not having urban powers, could not prevent it. In these, and sometimes in cow-houses, stables, and outhouses of various kinds, the slaughtering and dressing of carcases was accomplished. Much of the meat was sold without any inspection at all, and that which was sent to a public abattoir for inspection was submitted without the viscera, and stood a fair chance of passing even if it deserved to be seized. The first step to be taken, to bring about a more effective system of meat inspection, must be to give rural districts powers which they did not at present possess. This could not be done until the public were much better informed than now, as to the great danger of eating diseased and unsound meat, and as to the need of having all meat inspected by well-paid specially trained inspectors, as is done in France, and Germany, and some other continental countries.

MR. J. S. LLOYD (Veterinary Inspector for the City of Sheffield) said, in relation to the question of public abattoir versus private slaughter-house he thought private slaughter-houses should be abolished in all thickly populated districts, and strongly advocated the provision of small public abattoirs, conveniently situated near railway sidings or cattle markets. He preferred small abattoirs, chiefly for two reasons, that a larger number could be built and they would consequently be more accessible for the butchers, and that such could be easily supervised by one manager, who should also be a qualified meat inspector. Unfortunately, the abolition of private slaughter-houses raised the question of compensation, and in many towns (as in Sheffield, where he came from) this was an expensive matter, and often completely prohibited the provision of abattoirs. In speaking of country carcases he hardly thought Professor Delépine had gone far enough, he thought the word "suspicion" might have been replaced by the word "probability," as probably most country carcases were diseased; it being only a very few wholesale butchers who sent the dressed carcases of prime cattle into the dead meat market, the majority of butchers preferring to have fat cattle brought to their slaughter-houses alive. His experience as a veterinary surgeon was, that there was now probably less reason why cattle should be "killed to save their lives" than ever before, and particularly was this so in the case of cows suffering from parturient apoplexy, as cows so affected, thanks to modern veterinary treatment, recovered from the disease to a very much greater extent than formerly. He agreed that slaughtering on unlicensed premises should be prohibited, except in cases of accident and for home consumption. He would also advocate compulsory veterinary examination

of all diseased animals previous to slaughter, a system which he believed would put a stop to the slaughtering of animals in a moribund condition, and would also be a check on that serious complaint communicable from animals and carcases to man, anthrax. Indeed he strongly advocated a systematic examination of all animals and carcases intended for the food of man, such examination to be carried out in a uniform manner, on both practical and scientific lines by thoroughly qualified meat inspectors. That, in the speaker's opinion, could be best obtained by instituting a veterinary service of public health, something on the same lines as existing in Italy. He thought all counties and large towns should have their whole-time veterinary inspector, with approved local veterinary surgeons to act for their respective districts under the supervision of the whole-time officer. Such a veterinary service could act in conjunction with the medical service of public health, to the mutual advantage of both professions, and to the benefit of the public at large, and both should be subject to the control of a central board of public health, having a responsible member of the Government at its head. The speaker was aware that he was asking for rather a tall order, but he was quite convinced that with the veterinary and administrative work required under the Diseases of Animals Acts and Dairy Regulations, there was certainly plenty of work for such a veterinary service to perform. He was afraid, however, that there was no very immediate likelihood of such a service being created, and as a stop-gap for the present, he would agitate for the appointment of approved veterinary surgeons to act as meat inspectors in England and Wales, on the same lines as at present existing in Scotland under the Public Health (Scotland) Act, 1897, and the recognition of veterinary inspectors under the Public Health Act as meat inspectors on a level with medical officers of health and inspectors of nuisances, as recognised by the Swansea General Powers Act, 1902.

Dr. R. Sydney Marsden (Birkenhead) said he believed that many of those present were either inspectors of nuisances or candidates for the certificate of the Institute. He therefore proposed to add a few words on points in meat inspection as supplementary to the valuable paper they had had from Professor Delépine. First, the professor had alluded to the *reaction* of meat, which meant that certain test-papers called litmus papers (which were in two colours, red and blue, and could be bought from the chemists) changed their colour according to whether the juices of the meat were acid or alkaline. In either case the reaction was very slight; but he would like to warn them that unless they dipped the litmus paper into water before using it, they would not get the reaction, as otherwise the thin gummy serum of the meat glazed the paper and stopped the reaction, or intensified the colour. Second, as regarded the smells noticeable in certain conditions of meat, these were sometimes modified by being dipped in a solution of nitrate of potash. Third, as regards stripping the pleura, it was not *always* resorted to for the purpose of removing the evidence of a diseased

condition. It was sometimes used to take away the ugly appearance caused by blood-staining due to over-sticking. Fourth, with regard to dropsy, by which condition was meant a peculiar condition of the connective tissues, which were full of fluid of various kinds. [Dr. Marsden here demonstrated on a piece of beef what the connective tissues were, and showed how they might become full of exuded fluid: which might be blood-stained lymph as in inflammatory conditions; bile-stained lymph as in certain fevers, such as Texan fever, and also in certain kinds of jaundice; or might be urine, as in uræmic diseases.] Fifth, as regards jaundiced meat (that is, meat stained a deep yellow), this was a class which required much attention and some experience, as it was not all jaundiced or bile-stained meat that was unfit for food. For example, in certain breeds of cattle the fat and other tissues were naturally of a yellowish hue, as in Jersey and Guernsey beasts, whilst cattle from certain parts of Canada and the United States and South America vary in the tinge of the fat from saffron yellow to that of rich gold. This was a peculiarity rather than a disease. Animals fed on condiments, on brewery grain and spent malt, and often "prize" animals had this yellow colour, whilst a localized patch of circumscribed yellowness might be due to contact with the gall bladder or effusion of gall. Failing these causes, the discoloration must be looked upon as a result of functional or organic disease of the liver, due to cold, fever, Texan fever, or something of that kind. Where there had been fever other changes would be present, which would at once enable them to condemn the carcase. Failing these, it was often a difficult point to decide; but, if possible, the spinal column should always be examined. It always showed marked change in inflammatory jaundice. In the case of jaundiced sheep, the liver would often be found to be fluky. They should never judge of jaundice by gas or other artificial light. If sufficiently extensive, jaundice produced a bitter taste in the meat and gave rise to gastric and intestinal irritation and diarrhœa. In connection with the formation of abscesses, it was important that they should be able to distinguish between certain well-marked conditions that resemble each other to a certain extent. [He then described the formation and characters of a common abscess, a caseated tubercular nodule, a caseated actinomycosis nodule, and a caseated hydatid cyst, and showed how to distinguish between them.]

THE JOINTING OF PIPES FOR DRAINS AND SEWERS.

By Prof. J. RADCLIFFE, C.E.,
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(MEMBER.)

Read at Sessional Meeting, Manchester, February 2nd, 1906.

EARTHENWARE and stoneware pipes have long been used for the conveyance of sewage, but within the last few years considerable improvement has been made in the quality of the pipes used for that purpose. The improvement in the quality of the pipes was necessary to satisfy modern requirements, and to compete with pipes of cast-iron and other materials. Stoneware pipes have some advantages over cast-iron pipes, especially as regards the maintenance of a smooth interior surface, but frequently they lack strength, and always require a large number of joints. The supplementary strength may be obtained by using concrete, but the number of joints cannot be largely reduced, though attempts have recently been made to manufacture pipes of greater length. The result has not been altogether satisfactory.

The joints of cast-iron pipes present little or no difficulty, a caulked lead and gaskin joint being quite satisfactory, except in places where great variation of temperature takes place. In such cases lead joints fail, but joints made of plain gaskin, thoroughly soaked in Portland cement and well caulked, or of rust cement with a minimum quantity of sal-ammoniac, answer the purpose admirably. The turned and bored joint for cast iron pipes is not satisfactory, unless provision is made for the insertion of lead to maintain water tightness during any slight movement due to settlement, vibration, or other causes. Where rust cement is used, the protective coating must be removed from the cast iron where the surface is to be in contact with the cement.

The jointing of stoneware pipes is an important matter, and well worth the close attention of all interested in sanitation; leakage of sewage or air from the pipes may mean pollution of the soil, air, and

water about human habitations. That difficulties exist in regard to this is clearly shown by the number of patent joints now on the market. Great ability and ingenuity have been exercised by the inventors, and they deserve to reap a substantial reward from their labours, but in the author's opinion the wrong trail has been followed. Instead of dealing with the form of socket on each pipe, attention should have been given to the cementing materials used in the sockets.

As all are aware, clay was considered good enough for jointing earthenware pipes in by-gone days. Since that time Roman cement, Medina cement and Portland cement have been largely used for the purpose. The last-mentioned is now almost universally adopted, and everyone seems satisfied that perfection has been reached, and that there is no room for improvement. My experience, unfortunately, does not confirm this, and I ask those interested who have opportunities for observation to carefully test, by hydraulic pressure, lengths of stoneware pipe drains or sewers that have been laid over one year; I feel sure the result in many cases will disappoint the observers. One case may be mentioned.

In the drainage of a very large building by stoneware pipes, the work was done by day-work, the materials being of the best and supplied by well-known firms. The work was carried out in firm ground, under strict supervision and my directions. When finished the hydraulic test was applied to each length, and maintained for twenty-four hours, with satisfactory results.

Two years after the work was finished the whole of the drains were re-tested under my direction, the result being a great surprise to me; only two short lengths out of about forty lengths remained water-tight. The cast-iron pipes which formed one section of the scheme were found in good condition, and all the lengths were perfectly tight when severely tested. The defects in the stoneware drains were due to the expansion of the cement used for jointing purposes, long after it was supposed to be set, numerous fine cracks being clearly seen at a number of the sockets, whilst other sockets were broken. Many examples could be given, if necessary, to prove the results obtained in the above case. The defects are not confined to the ordinary forms of joints, but apply equally to many patent joints for which Portland cement is used, a peculiarity being that joints made by one man with the same brand of cement, and mixed at the same time, do not all show defects.

During the period of observation, which has been very extensive, a number of interesting details have been noted, some of which may be given here.

In the ordinary joint, with or without gaskin, there is a tendency for the soft cement, during setting, to leave the upper part of the socket, as shown in A, and to bulge out at B, Fig. I.

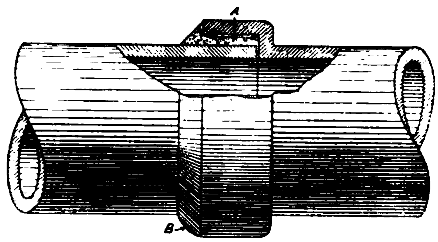


Figure I.

In a patent joint with a cavity, the Portland cement in the form of grout is run in and worked round with a cane or other appliance to exclude the air and entirely fill the cavity with cement. In this case the heavy particles of the cement settled to the bottom of the joint, and left the liquid portion at the top, before setting took place. On testing this joint after 48 hours exposure to air the upper part showed signs of leakage; on examination, the density of the cement was clearly greatest at the lower part of the joint, and may be likened to the shading of the cement in Fig. II.

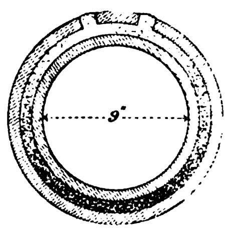


Figure II.

In another case, the ordinary cement joints were made with dry spigots and sockets (not dried specially); shortly after setting cracks began to develop in the cement, as was shown by the joint exhibited. The insertion of gaskin made no difference.

Pipes of the same kind were soaked in water and jointed with the cement mixed for the previous example by the same workman. Though the joints have been made some time, no defects are noticeable, as was shown by examination of the joint exhibited. A remarkable feature of

cement-joints is the small amount of hold that the cement, when set, has upon stoneware pipes; this is clearly shown by breaking a pipe joint.

In the joints without gaskin, or a substitute for it, there is great difficulty in preventing the cement, when in a soft state, passing round the end of the pipe and forming a ridge on the inside. The removal of this ridge may disturb the partly set cement in the joint, or a slight disturbance of the pipe may break the joint and cause leakage. Provision must be made to prevent this. The use of a small ring of gaskin does not reduce the strength of the joint, but a ring of fine plain gaskin, thoroughly soaked in cement, forced solid to the end of the socket, enables a cement joint to withstand higher pressure than if cement alone were used. A joint that will withstand considerable pressure may be made by filling and caulking the socket with plain fine gaskin thoroughly soaked with liquid cement, and afterwards pointing the face of the socket, as shown in

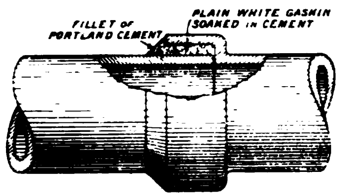


Figure III.

Fig. III. A joint of this kind has been made for inspection, and will with safety withstand forty feet head of water. I cannot say what effect the gaskin has upon the life of the cement, though joints of this kind made seventeen years ago are still withstanding a constant pressure of eighteen feet head of water.

With few exceptions, the joints submitted for your inspection are water-tight and gas-tight, but how long will they remain so? The answer is not easily found.

With care a cement joint may be made gas-tight and water-tight, but the action of Portland cement is so peculiar that no reliance can be placed upon it as a jointing material for stoneware pipes. As previously mentioned, the tendency to expand long after setting is the great weakness. This has done more than anything else to extend the use of cast-iron pipes for drainage purposes, as engineers (especially in America) hesitate to carry out high class work with material that may cause the work to be defective in a few years. There are no tests except those extending over a considerable period that will give reliable information on the point. All those who have experience in this class of work, know that the principal

part of the cement used for this purpose is purchased by contractors in the cheapest market, and frequently in small quantities. The cement is used without the application of any test, in fact a knowledge of the specific gravity of the cement would be useless; the chemical composition of the cement would indicate nothing in the direction named, as a variation of the conditions under which two samples of the same composition are burned or calcined will cause a difference in their expansive properties; the test for tensile strength would also be useless, and the variation of temperature during setting would indicate unsoundness which aëration might remedy, but would not indicate anything as to the action of the cement some time after use. The addition of sand to the Portland cement will not remove the difficulty.

The tests used to determine the amount of expansion are satisfactory, so far as they go, but only cover the action during short periods. Authorities almost agree that the maximum expansion after twenty-four hours aëration should not exceed 12 millimètres; but a good sample may show an expansion of only 2 millimètres, another sample under exactly the same conditions may expand 40 millimètres. In both cases there is a total absence of proof that there will be no further expansion in the future. In several cases cement, moulded in lengths 47·124 ins. × 3 ins. × ½ in. (as used in the joint of a 12-in. pipe) has shewn an increase in length of ¼ in. The pressure generated in a confined space by the expansion named would be difficult to accurately ascertain. In my opinion, the evidence is sufficient to justify the search for a material of a less uncertain character, and I place before the meeting the result of my experience, in the hope that others will supplement it, for the benefit of those whose health depends upon the efficiency of work of the class referred to, and to prevent the expenditure of money upon work which may prove defective in a short time.

In seeking to remedy defects a man naturally endeavours to obtain information regarding the experience of others, and to apply the best results to his own case. I found that coal-tar pitch had been used in several cases, and also that pitch mixed with sand and other ingredients had been employed for jointing pipes for drainage purposes, but the results had been unsatisfactory.

The chief properties of material suitable for the purpose are:—

1. The cost must be reasonable.
2. Highly skilled labour must not be essential to its application.
3. The material must not fail by variation of temperature, expansion, contraction, vibration, or natural decay.

4. There must be a small amount of elasticity to prevent leakage in case of slight settlement of the ground in which the pipes are laid.

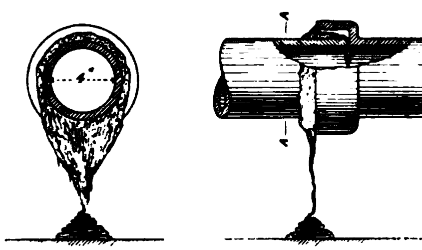
5. The material must obtain a firm hold on the surface of the pipe and socket.

6. The material must set within a reasonable time, to allow the joints to be thoroughly tested before the pipes are covered up.

During the last five years I have carried out experiments with various materials, and during that period joints made with many substances have been in use and under close observation. The best results were obtained by using sulphur, and bitumen. The first-named made a sound joint when run in a molten condition into the socket or cavity, but owing to the peculiar properties of sulphur some difficulty was experienced in making the joints. The conclusion arrived at was that sulphur alone is unsatisfactory for the purpose (conditions 2, 3, 4 and 5 not being entirely satisfied).

Mixtures of sulphur and bitumen have also been tried, but the tendency of the two substances to separate made it difficult to obtain a mixture of uniform consistency. The variation in the melting points of the substances added to the difficulty. It was found that at a low temperature crushed sulphur simply acted as sand in the melted bitumen; under the best conditions obtained by mixing the two substances, the result did not justify its use on a large scale, the same conditions remaining unsatisfied.

Extensive experiments have been made with bitumen in various forms, including coal-tar pitch and natural rock asphalte. Materials have been supplied for the purpose by the Val de Travers Co., the Limmer Rock Asphalte Co., the Brunswick Rock Asphalte Co., and others. The results were such as to justify further and extensive trials; two important points were clearly shown, namely, that coal-tar pitch alone is unsuitable for the purpose, and that other forms of bitumen mixed with an excessive quantity of oil should not be used. In both cases a creeping action is set up at ordinary temperature, so that in soft ground the ordinary socket of a pipe may be practically emptied by this action. Fig. IV. shows the



Section through *A A*. Figure IV.

action referred to, and a joint of this material was available for inspection. A mass of the same material creeping over a glass plate was also shown. This action is the principal one to be observed and prevented. No difficulty need be experienced in detecting faulty material of this kind. The low melting point would indicate an excess of oil, or the slow setting and lack of hardness of a small quantity of the heated substance when allowed to cool in air or when placed in cold water would give the same information. The simple tests referred to may be easily applied by a drainage inspector in a very short time, without special appliances.

The best results were obtained by carefully heating three parts of natural rock asphalte (hard mastic) with the addition of one part of coal-tar pitch and one part of fine clean sand (the pitch and sand were heated and mixed before being placed in the asphalte); the pitch caused the heated mass to liquefy sufficiently to run into the joints of the pipes (ordinary and patent). A simple arrangement for comparing samples of the material as regards their power to resist softening influences was shown. Pieces of material of equal weight are suspended in glass beakers containing cold water, the temperature is slowly raised to boiling point, and the result carefully noted as follows:—

		Time.
No. 1 Sample.		
Temperature of water and material	12° C.	—
Material becomes plastic	30° C.	40min.
„ commences to creep	41° C.	1hr. 0min.
„ melts	80° C.	1hr. 30min.
No. 2 Sample.		
Temperature of water and material	12° C.	—
Material becomes plastic	35° C.	38min.
„ commences to creep	65° C.	1hr. 8min.
„ melts	95° C.	1hr. 23min.
No. 3 Sample.		
Temperature of water and material	12·5° C.	—
Material becomes plastic	25° C.	35min.
„ commences to creep	35° C.	50min.
„ melts	65° C.	1hr. 5min.
No. 4 Sample.		
Temperature of water and material	14° C.	—
Material becomes plastic (slight)	75° C.	35min.
No creeping action	100° C.	1hr. 0min.
No melting action	100° C.	

No. 5 Sample.

Temperature of water and material	13° C.	...	—
Material becomes plastic (slight)	85° C.	...	33min.
No creeping action	100° C.	...	1hr. 0min.
No melting action	100° C.		

The principal point requiring attention is the temperature at which the material creeps. This should be as high as possible; material that only creeps at high temperature shows a clean fracture in section when broken, as shown by the broken samples prepared for inspection.

The material referred to satisfied the conditions previously mentioned in the paper, so far as the author has been able to ascertain.

The cost is reasonable, and in many cases much less than Portland cement, when all matters are taken into consideration, as there need be no waste; the trench need not remain open, as with cement when waiting for the cement to set sufficiently hard to enable tests to be applied. A defect in a joint may be quickly made good by using a plumber's lamp or hot iron. In work recently carried out there was a considerable saving of time, and few joints leaked when under a very sensitive hydraulic test.

Highly skilled labour is not required in its application, the ordinary drain layer is fully qualified to make the joints.

The practical application of the material on a large scale for jointing purposes has shown to the author's satisfaction that, with proper care in the preparation of the material, there will be no failure due to variation of temperature, expansion, contraction, vibration, or natural decay.

The lengths of pipe placed before the meeting for inspection were jointed over three years ago, and now contain compressed air at a pressure of 4 pounds per square inch without leakage. The pipes were not made specially for this test, but were supplied as material for a large drainage scheme. The pipes are fitted with Button's patent joint.

A peculiar and unusual circumstance occurred during the laying of a line of 12″ pipes, jointed by bitumen in this form, and which served to illustrate the existence of elasticity in the cementing material. The pipes were laid and jointed ready for testing on Saturday noon. They were secured at the lowest end by the joints to a large fireclay chamber bottom, the chamber being built of the best blue brick in cement mortar. The testing plugs were inserted in the pipes and left until Monday morning.

The workmen then found the trench containing the pipe filled with rainwater, and the loose end of the pipe floating near the surface of the water. The clerk of works expected that the joints would require to be

remade, but, to his surprise, when the water was pumped out of the trench, and the pipe settled down, on the application of the hydraulic test the joints were found uninjured, and passed as satisfactory by the clerk of works.

A very great weakness of ordinary cementing material is the insecure hold which it obtains on the surface of the pipe or socket, especially if the surface is slightly glazed. Bitumen, if properly applied, overcomes this difficulty to a considerable extent; but if the cavity or spigot and socket is coated with a film of the heated material, the hold secured by the material on the pipe is in some cases much greater, and the general efficiency of the joint is increased.

It is important in almost all cases that the pipes should be tested before they are covered with earth. Frequently great inconvenience is experienced by having to leave trenches open for a sufficient time to allow the jointing material to set, and to repair defective joints. Bitumen removes this difficulty, as joints made of this substance may be tested under a considerable head of water in less than one hour after the joints are made.

The material under consideration is not only suitable for the joints of small pipes, but pipes of large diameter may be jointed by it. A 12-in. pipe joint was prepared (in the manner previously described) for inspection (Fig. V).

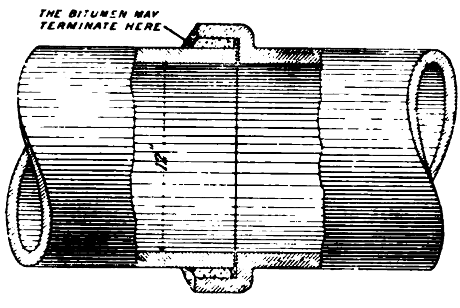


Figure V.

In the case of large joints it is advisable to use a pan with a valve in the bottom, so that the joints may be run without break, as the material is very like lead when brought into contact with cold surfaces, and sets quickly. For ordinary joints on pipes up to nine inches diameter a clay fillet is satisfactory for running the joints, but above that size clips (as used for cast-iron water-pipe joints) are best. The heavier parts of the bitumen should not be allowed to settle to the bottom of the pan in which the material is heated.

I would like it to be clearly understood that the best results of experiments carried out in the laboratory, and previously referred to, have been applied and thoroughly tested in actual work. In a scheme completed two years ago at a cost of over £8,000, pipes varying in diameter from four inches to twelve inches were all jointed by bitumen of the kind mentioned with very great success.

I have endeavoured to obtain a material that may be used (without extra cost) for ordinary or patent joints, that will not possess the uncertain properties of Portland cement when used for jointing pipes for drains and sewers.

In conclusion, I desire to thank those who have rendered assistance in the preparation of matter for this paper, with special mention of Mr. Herring-Shaw, Mr. Chadwick, and Mr. Newsome.

MR. J. CORBETT (Salford) thanked Prof. Radcliffe for having so effectually worked out a problem which had long needed attention. Referring to the great improvements recently made in practical sewering work, he mentioned that fifty years ago the municipal authorities in Manchester used oval sewer pipes without sockets, and thirty years ago they prohibited the use of circular pipes, and hence some surveyors used the approved pointed-oval pipes point upwards. He considered it absolutely necessary to provide for a slight movement of the pipe joints, even on the firm foundations generally available in this district, pointing out that the reason for making tile pipes only two feet long was to prevent their breakage by permitting movement at the joints, and but for this they might be made six or ten feet long. He objected to the costly and very strong joints now offered by many patentees, as they were stronger than the pipes, and thus caused breakage of the pipes. The various self-made joints, allowing a slight movement, and being so nearly watertight as to generally become tight by the glutinous matters in the sewage, were, in his opinion, the best system of jointing now in use. He had thought of, but never yet used, a system of pliable jointing which might be worth consideration, that was to put cast iron rings round the sockets, bedded in cement, so that the sockets could not be broken, and then caulk the joints tightly with tarred oakum, just as wooden ships were caulked. But he should certainly try to make use of the evidently excellent system proposed by Prof. Radcliffe.

MR. A. M. FOWLER (Manchester) said that he welcomed the paper, because it was time someone took up the matter of making joints for sanitary pipes, for there were some twenty to thirty patent joints on the market, but as "comparisons were odious," he did not wish to say one word in disparagement of any particular make, though some were better than others. But before discussing

the jointing itself he would call attention to the fact that all the patent joints now so profusely advertised in the engineering papers were on the basis of circular pipes. As the makers of pipes could more easily make the circular pipe than an egg-shaped pipe, it followed that they leaned to manufacturing them. The joint-makers could also make their joints much easier to a circular pipe. He mentioned this because it would seem that they were degenerating in the adoption of the best form of pipe for securing the best possible velocity in the flow of sewage, to keep the sewers clean. He did not mean for small pipes, because small circular pipes of course had a minimum-sized invert, and secured the best shaped invert for the flow, but large pipe sewers of egg shape, say from 16 inches by 12 inches, up to 2 feet 6 inches, by 1 foot 9 inches, adapted themselves for securing the best hydraulic mean depth in the flow, by thus narrowing the invert. Egg-shaped pipes had been largely used by himself in carrying out many miles of sewers in Leeds, Salford and other large towns; this form of pipe being the outcome of careful investigation about the year 1842, by the late Captain Vetch, R.E., and George Leather & Sons, after great research and inspections of sewers in large towns. It was not until about the same year, at Leeds, that the socketed sanitary pipe was introduced. Whatever method of making joints was adopted, a great deal depended upon the sagacity and attention of the clerk of works, for an engineer might design ever so good a joint, but unless it was carefully carried out on the ground it would be of little or no avail. In the case of a joint made of Portland cement: in the first place, the pipe was required to be laid true at the invert joint to prevent drifting, the cement should be of an approved make, well dried, tempered and tested before use. It was no test to a joint to put the pipes under pressure before being covered up, inasmuch as it was impracticable to keep the sewer trench open, say for a fortnight, to allow the cement to set, and better again if standing a month. Cement always sets better in an even temperature, or when surrounded with moisture, as in pipes covered up in the ground, or in still water, than being immediately subjected to a test of pressure. All cement or concrete was better for setting underground than on exposed surfaces, although there were some very good examples of surface cement-work, for instance, the platform of York Railway Station. Generally, the absence of these conditions was the cause of complaint of expansion and contraction in the jointing of pipes. He had made joints to pipes for sewers 1 foot 6 inches, and 2 feet diameter, for upwards of five miles in length, with tarred gaskin pointed with Portland cement, where the pipes had had 4 to 5 feet head of water in the trench after the joints had been allowed to set properly, and these had been found watertight for all practical purposes. Also, pipe sewers from 1 foot 6 inches to 3 feet diameter, with joints formed of bitumen made at the maker's works, and pointed with cement, when laid. The larger size joints cracked by reason of expansion of the bitumen, although all the pipes used were one-tenth of the diameter in thickness. Joints of bitumen referred to in the paper, he understood, must be made on the ground,

especially the pointing. The heating and tempering of this material must necessarily be carried out by an experienced workman. Of course, there was a limit to expense, and if a good joint could be secured without resorting to any of the costly patents, he said it behoved engineers not only to do their work efficiently but economically. When it was considered that some of these patent joints added something like 75 per cent. to the cost of the pipes alone, it became serious, especially in larger pipes, where the desired efficiency was not secured. The contingencies to be met in this respect were not so great in small pipes as in the larger sizes. Not only in the jointing, but in the laying and fixing of the pipes in the trench, care in securing a good bed along the barrel of the pipes was necessary to secure a permanent joint, and where the ground was bad, of course a good joint could not be secured, unless laid on a bed of concrete, and in some cases other provisions were necessary. He would say in conclusion that to secure a good joint, of whatever character, simplicity and careful manipulation of construction should be the aim, for whether it be of cement, or tarred gaskin and cement, or of the patent bituminous joints, or the joint advocated by the author of the paper, it must be carefully made, especially in bitumen, which had to be mixed and tempered so as to set to a uniform consistency.

MR. COARD S. PAIN (Liverpool) said he was glad that this subject had been brought forward, as it was particularly suitable for discussion in Lancashire, where the practice of using clay joints still obtained in some rural districts, and was justified on the plea of elasticity being desirable in places subject to subsidence. It appeared to him that even gradient and water-tight joints were essential to a well laid drain, and rigidity of joint was necessary to ensure these conditions. If elasticity prevailed it was probable that leakage would follow, and elasticity meant uneven gradient, and consequently ponding and deposit of silt. It had been urged that if there were no elasticity in the joint, and the foundations were bad, the pipes would break across the middle, which was the weakest point. Better let them do this, which would necessitate proper foundations being provided, than to leave undetected leaky joints. Where foundations were defective, bedding in concrete was largely adopted, but too much reliance must not be placed on it, as even when six inches thick the cavity that could be bridged or the weight supported was not large, and where the foundation was very bad it was better to adopt other measures. It was probable that damage from superimposed weight occurred generally at the time of filling the trench, as when the soil was once consolidated it formed a natural arch by which the weight was transferred to the side of the trench. As regards stoneware drains not standing after being laid for some years, his own experience was that drains well laid in the first instance on good foundations and of moderate gradient did stand the test; but he had noticed that difficulties were generally found to exist in the branches which were laid at a greater

gradient, and often put in on partly filled trenches or other bad foundation. He considered that 24 hours' test was very severe for new joints with anything but a small head of water. If cement joints were properly made no ridge should exist, as any cement squeezed out in making the joint should be removed as each pipe was laid. He doubted if gaskin was an advantage, as it reduced the superficial area of contact and length of joint. He had found that cement would adhere to the spigot and socket if they were roughed and left unglazed, so much so that he had never yet been able to use old pipes in relaying a drain, as they broke in trying to get the cement off. Bitumen was used in two ways for joints (*a*) cold as in Stanford's and (*b*) applied hot as advocated by the author of the paper and others. To ensure a fit in the former the surface of the bitumen had to be somewhat convex, which reduced the area of contact and increased the chance of leakage, but this class of pipe was very useful in waterlogged ground. Bitumen applied hot required very careful treatment in mixing the materials in proper proportions, and in heating and stirring. If it was too soft it ran out, if not soft enough the space was not filled, and herein lay the great difficulty in the use of an undoubtedly good material by other than skilled labour. Cement joints required to be skilfully made, and he thought the author's bituminous joint required even greater skill, which it would be found difficult to obtain, except in large work. In conclusion he considered the excellent composition submitted by the author was a decided step in the right direction towards obtaining a desideratum, as to the necessity for which there could be no doubt.

Mr. S. S. Platt (Rochdale) said he quite agreed with Prof. Radcliffe's desideratum of a satisfactory jointing material, and his strictures on those which have proved unsatisfactory. One point in particular, very necessary to be borne in mind at the present day, was the detrimental effect on the jointing of drainage pipes under busy thoroughfares subject to vibration from heavy motor traffic. He would supplement the remarks of Prof. Radcliffe that the removal of the protective coating of cast-iron pipes was an absolute necessity where the jointing material was Portland cement, or where iron pipes were built in manholes of concrete or brickwork. He had tested joints made with somewhat similar composition to that advocated by the author, and found them very satisfactory under water-test. Owing to the introduction of the human element in judging as to the temper of the bituminous mixture before use, it would be advantageous if such material could be obtained ready prepared as to the proper proportions, only requiring heating and stirring, so that it could be satisfactorily used by ordinary skilled drain layers; and the facility with which after test any defective joint could be easily made good was also greatly in its favour. The precautions mentioned towards the end of the paper were very necessary to be observed to insure successful work.

Volume XXVII. No. 3. Issued April, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONFERENCE ON SMOKE ABATEMENT.

Thursday, December 13th, 1905.

SUBJECT: **"FACTORY & TRADE SMOKE ABATEMENT."**

ADDRESS

By SIR WILLIAM H. PREECE, K.C.B., M.Inst.C.E., F.R.S.

(VICE-PRESIDENT AND FELLOW.)

I REMEMBER reading in the autobiography of Benvenuto Cellini (1500–1572), some comparisons he drew between the climate, clearness of atmosphere, and blue skies of Florence and Paris, to the great advantage of the French capital. What would he say now? I have seen Paris dressed in a real good London fog; and the reason given was that the French, like the English, have taken to burn coal regardless of economy and consequence. On the other hand, I have only just been reading an admirable comparison between Birmingham and Berlin, from the brassworkers' point of view, recording the observations and conclusions of three Birmingham social reformers, without political bias, in a ten days' visit during last April to the Prussian capital. They went really to inquire whether the brassworkers in that city have succeeded in attaining a more desirable physical and industrial life than that led by the brass-workers of Birmingham. The report is most interesting. It is published by Hudson & Son, of Birmingham, for one penny. Berlin has a population of 2,000,000. It is a city of cleanliness. They visited some workmen's dwellings. The report says:

> The heating stove was a beautiful structure about 8 feet high by 3 feet wide by 2 feet deep, built of glaze white tiles. There is scarcely any heat wasted in these stoves, and one cannot see the fire as in an English fire-grate, as it is all closed up with double doors. There is no dust or smoke

of any kind from this class of stove. It is not easy to convey to anyone who has not seen one of them the exact idea of what they are like, but that they serve the purpose of heating the room in a most uniform and economic manner is at once apparent. The stoves can best be described as large radiators, and give out the heat to great advantage. The fuel used is not ordinary coal, but a patent fuel, which is in oblong blocks of about the size of half a brick, and costs about 1s. per week, and may have something to do with the comparative absence of smoke in Berlin.

Here is another reason from Germany! "It is evident," says the report, "that the Berliners have made this cleanliness the starting point in beautifying their city, and in all their social relations." If cleanliness is next to godliness, then must cleanliness rank first in the class of sanitation. Pure air, pure food, pure water follow next, and pure soil, pure dwellings and pure bodies bring up the rear. Cleanliness and purity lead to health and to economy. It is to these last two points that I wish to direct your attention in considering and discussing the abatement of smoke.

During the last few days we have had a great object lesson. London has been fog-blocked. I was kept late last Monday night an hour and a quarter outside a metropolitan railway station because the impenetrability of the air to light, owing to its deep saturation with water globules, rendered all signalling operations impractical. What is the connection between smoke and fog? The air is always charged more or less with moisture. Pure water in the gaseous state is perfectly transparent, and the amount of humidity in every cubic metre of air is easily measurable. There are certain points of pressure temperature and impurity of the air when the otherwise transparent vapour will condense into cloud and rain. Each particle of matter suspended in the air becomes a nucleus round which molecules of water assemble, becoming opaque and therefore visible. Every single being who breathes fog-charged air has ocular demonstration on his pocket-handkerchief that his mucous membranes are clogged with black particles. These have been proved to be carbon, and it has been shown that carbon particles are the cause of the density and darkness of London fogs.

The presence of carbon particles in the air is a proof of the imperfect combustion of coal in our domestic as well as in our factory fires. If the combustion had been perfect no solid carbon could be present except as carbonic oxide or carbonic dioxide, which are gases and invisible. Hence the removal of this matter from the air means not only purification of the air but economy of production, for it must increase the efficiency of the

furnace. To minimise fog we must, therefore, reduce the number of carbon particles in the air, and this is to be done by improving the methods of combustion.

The removal of these carbon particles must also influence health, for everyone knows the distressing effect of fogs on coughs and colds. I have recently spent a few weeks in South Africa. I caught a severe cold in ascending 6,000 feet to the Transvaal. Johannesburg suffers occasionally from a plague of dust. A fine impalpable dust is driven about by the wind, sometimes forming great clouds, and occasionally giving the appearance of fog. There is no real fog. The air is too dry. But this dust percolates every mucous membrane of the body and renders life scarcely worth living for brief spaces. My body for a week or so became a dust-bin, and my handkerchiefs were brown with the dust of this dust-laden, but otherwise charming place.

The proposals to establish a few large power-houses on the river in London to supplant the 70 or 80 scattered electric generating stations that now exist have one great merit; they will abate the nuisance of smoke and introduce more perfect methods of fuel combustion and so reduce fog, for the cheapening of the cost of production of electric energy means the adoption of every known means of economy.

Internal combustion engines where producer gas is sucked in and exploded is another promising field for the enthusiast. They produce no smoke and discharge no particles, but they are limited at present to small engines and are not yet applicable to the great power-houses that are now increasing in all industrial areas.

It is probable that the greatest sinners are the ordinary domestic grates, the most unscientific and inefficient heat producers in existence. Their consideration does not come within the function of this section, but I cannot resist condemning a system which patriotism, conservatism, or sentiment maintains popular, aided by the abundance and cheapness of coal. The supposed cheerfulness of an open fire is proverbial, and there may be some truth in it for it certainly aids ventilation. On the other hand it encourages draughts, and causes the distribution of heat to vary immensely in different parts of the room. I have remedied this last defect by having an open fire at one end of the room and a radiator excited by hot water or by electric currents at the other end. The price of electrical energy is falling so rapidly that the electric radiators will soon become a domestic comfort within the reach of all.

The baneful influence of smoke on health is not confined to inhaled

material particles, it reduces daylight and deprives us of the sun. It deteriorates plant life and it coats every exposed surface with soot, tar, and acids. Mr. Mactear in 1875 stated that 245,000 tons of sulphuric acid were belched forth in London in one year. Dr. Rideal makes out that it is now more than twice as much.

There are many well-known smoke consuming processes. Bituminous coal can be burnt completely so as to emit no smoke. It is only necessary (1) to regulate and heat the air supply to the furnace, (2) to secure and maintain the proper temperature in the furnace, and (3) to control the escaping gaseous products up the chimney. Such arrangements are undoubtedly economical. Crossfield & Sons, of Warrington, have saved 1,000 tons of coal per week by adopting scientific smoke abatement methods. Newnes & Co. and the Cardiff Railway Co. assert that they have saved 25 per cent. of their coal consumption. A firm of brewers in London has saved £3,500 per annum, and I can speak from my own experience that wherever such appliances have been used marked economies have followed. But it must be remembered that chimney, flue, furnace, mechanical stoking, air regulation, preparing, elevating, and conveying fuel, water heating, all lend their weight to the desired consummation, the complete conversion of the potential energy of coal to the kinetic energy of heat and the total elimination of smoke.

There are certain peaceful methods of attaining this goal by gas, oil, and electricity, but we are here to discuss smoke abatement.

The production of smoke is a wasteful, dangerous, and useless barbarism, and I hope this Conference will drive that fact home.

The Smoke Abatement Society prides itself on the number of convictions it has obtained under the Public Health Act of 1891. It would be much more satisfactory if they recorded the number of firms who have adopted scientific measures and shown their economical results. This would excite emulation, a very potent force in commerce and industry. Law is not so effective as simple common sense. Satisfy people that smoke is matter in the wrong place and that money can be saved by its prevention, they will save money. Most people rejoice in doing what they are told they ought not to do; it is the cussedness of human nature.

Legislation is often obstructive, for it excites the love of resistance to enforced action against personal will and party proclivities. People will not adopt smoke consuming systems if they can avoid it simply to comply with supposed parliamentary tyranny, just as certain classes resist the progressive clauses of the last Education Act. It is different when you

touch their pockets, and when you convince them that economy results. Then political objections disappear, and common sense, or in other words, science, reigns supreme.

I think legislation would be looked upon with more favour if "emitting black smoke" were regarded as an occasional exceptional occurrence, and treated as an ordinary nuisance, done without negligence, and which had been provided against by every reasonable precaution as determined by Lord Blackburn's judgment. Sudden fogs, sudden breakdowns, unexpected accidents may cause the steam to lose pressure, and then the engineer in charge has to decide between loss of voltage and presence of smoke.

I should always support the maintenance of voltage, for the loss of voltage would affect a large district and a great number of innocent people, while the presence of smoke might affect one engineer only.

However, there is no excuse for neglecting reasonable precautions.

STOKING AND SMOKE ABATEMENT.

By COMMANDER W. F. CABORNE, C.B., F.R.A.S., F.R.G.S., F.R.Met.Soc.

IT can, I think, be laid down as an axiom that good stoking is the main factor in the prevention of the emission of smoke from furnaces.

In fact it may be broadly asserted that an intelligent and well-trained stoker will often obtain better results from indifferent coal than will a less expert man with superior fuel. In other words, the skilful workman not only avoids committing a smoke nuisance, but at the same time effects a considerable saving of coal, to the benefit of his employers.

I am not overlooking the fact that the quality and nature of the coal used, as well as the design and construction of the boilers, furnaces, etc., have also an important bearing on this question, and form material component parts of it; but what I particularly desire to lay stress upon is the paramount value of the personal equation.

In support of the proposition I will give some extracts from "Reports on the Laws in Force in certain Foreign Countries in regard to the Emission of Smoke from Chimneys," presented to Parliament in February, 1905; the information having been furnished to the Foreign Office by His Majesty's representatives abroad, while the return itself is due to the initial action of the Coal Smoke Abatement Society.

Mr. Richard Seymour, attached to the British Embassy at Vienna, wrote: "In the first place it must be emphasised that the compulsory introduction of technical measures to procure smokeless or almost smokeless fires would only be practicable if thoroughly adequate appliances existed to ensure the desired result. In this connection experience shows that no system hitherto recommended and applied is exempt from serious disadvantages. The best laid furnace requires constant supervision and attention, nor will it burn properly unless carefully tended. There is a well-known saying to the effect that a good stoker is the best consumer of smoke."

Mr. E. Hicks Beach, Third Secretary of the British Embassy at Paris, said: "Choice of fuel, care in stoking furnaces, well-constructed chimneys, may contribute largely to the restriction of smoke, but cannot entirely prevent its emission."

While Mr. Arnold Robertson, Acting Third Secretary of the British Embassy at Berlin, stated that: "In the opinion of the Prussian Government the employment of proper firemen will go far to minimise excessive emissions of smoke."

From the same document one learns that in the Kingdom of Würtemberg the following clause is usually inserted in a licence to construct steam-boilers: "The owner of a steam-boiler is required to see that the fuel is as far as possible entirely consumed, and to endeavour to prevent smoke and soot by using fuel of proper quality and in proper measure, by suitable flues and by careful stoking, and he must further undertake to have such structural and other alterations made as may be from time to time required to attain the object in view."

Mr. Edward Atkinson, President of the Mutual Boiler Insurance Company of Boston, U.S.A., in a report on the suppression of smoke, dated July 18, 1901, said: "Smoky chimneys give evidence of waste of fuel, not because the calorific value of the visible smoke is considerable, but because the existence of the smoke is evidence of bad methods of firing and of incomplete combustion. This may be caused by want of skill in the fireman; by overloading the boilers with work; by insufficient fireboxes and imperfect settings. The smoke may be suppressed in many cases by closer attention on the part of the firemen. . . . ."

A few months ago the Coal Smoke Abatement Society circulated certain questions among manufacturers and others who had once been offenders against the Smoke Prevention Clauses of the Public Health Act, and had since amended their ways, asking for information as to the means which they had adopted for the prevention of the emission of smoke. As Dr. Rideal is dealing with the replies received, I will only say that, while some of the firms in question had substituted gas-engines and electricity for coal-driven machinery, a considerable percentage of them placed their dependence largely, if not altogether, upon good stoking; and the following quotation from one of the answers may be considered typical of the views expressed by the latter section: "Even when so-called 'smokeless' coal is used, it does not necessarily follow that smokeless combustion takes place, unless care is given to the proper design of the boiler and furnaces, and unless the stoking is carried out with intelligence and care. We exercise great care in the selection of suitable men as stokers, and to a great extent

these men are trained at our works, and they are always under the close inspection of our engineers. The wages paid to the leading stokers are somewhat high as compared with the average wages paid for this work in ordinary factories, but we consider that the extra wages paid to a really competent stoker are easily saved by the economy of fuel which he can effect by securing proper combustion in the furnaces."

Of smoke-consuming inventions, one gentleman wrote: "We have many times tried using bituminous coal with different sorts of smoke-consuming apparatus, but our experiments have never been wholly successful, and I do not believe that the apparatus is in existence that will prevent smoke under all conditions. With nearly all smoke-consumers you are more or less dependent upon careful attention of the stokers."

Another correspondent, speaking of the manner in which his firm was at one time harried by a prominent member of the Coal Smoke Abatement Society, said: "He made it a rather warm corner for us, but his action led to economy, so I must be thankful to him."

It was about thirty years ago that high steam-pressures began to claim the earnest attention of engineers, a pressure up to 50 lbs. per square inch having previously been that generally in vogue; and in the period covered by my own sea-going days, I have known a pressure of less than 30 lbs. per square inch on the boilers of a then modern steamer in good condition.

The varieties of coal used in bygone years were few compared with those now drawn upon; their calorific values were little understood; analysis of their several qualities was seldom made; their evaporative power was rarely ascertained, etc.

The last three decades have witnessed a complete revolution, or perhaps one should rather say evolution, in all these matters.

We now possess huge and delicate boilers, comprising water-tubes, economisers, etc., some of them capable of evaporating from 30,000 to 40,000 pounds of water per hour, and requiring that the utmost amount of care should be exercised in their management in order that the maximum quantity of carbonic acid (CO_2) may be made, that being a condition equivalent to, or almost equivalent to, thorough combustion.

This being the case, the stoker of the present day, if his full value is to be developed, requires to know how to fire efficiently with an almost endless variety of fuel: such as bituminous, semi-bituminous, Welsh, dry Welsh coal, anthracite, bastard anthracite, coke, coke breeze, etc., the fixed carbon in the various descriptions of coal varying from about 50 to 92 per cent., and the resultant ash ranging from 3 to upwards of 20 per cent. Some of these ashes do not make much clinker; others, again,

make heavy, tough clinker. A number of collieries in England, Scotland, and South Wales now wash a considerable portion of their output.

It is also requisite that a thoroughly capable stoker should understand how to burn from 10 to 40 lbs. of coal per square foot of grate-surface per hour with any coal that may be supplied; that he should comprehend how to manipulate his dampers (and weather has great influence upon chimney-draught) so as to save coal and at the same time to keep a sufficient head of steam; that he should know how much air to admit, either by opening or shutting the dampers or cleaning or pricking his fires; that he should be competent to work the feed-pumps and injectors; and, in addition, it is desirable that he should be able to test the flue-gases for temperature and also for carbonic acid (which should amount to 15 or 18 per cent.), because, although the stoking may be excellent, these tests may disclose the fact that the flues are letting in air, which is fatal to satisfactory results.

One great difficulty in many large towns, and particularly in London, is the lack of room for the additional boilers required by factories owing to the expansion of their trade, as this necessitates the burning of more coal per square foot of grate-surface per hour under the boilers already installed, and it appears to be not unusual for 40 lbs. of coal, or even more, to be so consumed per square foot of grate-surface per hour; whereas, in normal cases, 20 lbs. of coal would give higher proportional efficiency.

It cannot be too strongly impressed that the forcing of inadequate boiler power is one of the prolific causes of factory-smoke.

The saving of fuel which a good stoker can effect is an argument for his being well paid, and some firms reward their stokers with a bonus, calculated upon the value of the amount of coal it is estimated they have saved. This possesses another advantage, that the stoker will soon complain to his employer in the event of the coal-merchant endeavouring to palm off upon him an inferior coal.

Now, the proper training of stokers has been strangely neglected, especially in connection with men employed in small works.

In the case of large installations of steam-boilers, trained men are frequently engaged to supervise the other stokers; but such qualified persons are difficult to obtain.

This being so, such devices as mechanical stokers are brought into play, but it does not seem probable that they will supersede hand-firing to any great extent, owing to the drawback of wear and tear, and also to the certainty that moving machinery exposed to the intense heat of furnaces is specially apt to get out of order.

It is said that mechanical stokers cannot efficiently handle Welsh dry coal or anthracite, and, if such is the case, it is a serious disability in their use, at any rate as regards London, as those descriptions of coal are almost free from smoke, and can be delivered here sea-borne at about the same price as English and Scotch coal.

I prefer to pin my faith to the properly trained human element, and particularly in the case of small installations, which form the preponderating number. However, in the case of large installations, I am aware that it is occasionally argued that the cost involved by manual labour outbalances the advantages obtained thereby.

Nothing has hitherto been said by me about induced draught, but it would seem that the time is not far distant when huge chimneys will give place to small ones and suction-fans, and the waste gases will be used to heat the air supplied through the ash-pits; and that would naturally tend to reduce smoke-nuisance, as by its introduction perfect combustion would be more nearly obtained.

We have seen what should be the qualifications of a thoroughly competent stoker, and we are aware how far short he frequently falls of the ideal we have set before us; it may not be inopportune to glance at the manner in which different classes of stokers are manufactured.

In the case of the Royal Navy, the young men enlisted in the stoker branch of the Service are sent to a harbour depot-ship, where they are instructed by engine-room petty officers in the handling of shovel, slice, and pricker, and in the duties and general routine of the stoke-hold, and they afterwards perform duty on board instructional torpedo-boat destroyers and torpedo-boats, being the whole time under the strict supervision of capable teachers. The course of instruction, the exigencies of the Service permitting, usually occupies some nine months, and then the full-fledged neophyte is drafted to a sea-going ship.

In the case of the Mercantile Marine, as a rule no real preliminary training takes place, the man originally engaged as a coal-trimmer, after some little experience in that capacity, succeeding in due course to the higher rating of fireman or stoker.

In this country there seems not to be any provision made for training of stokers for land-service.

I understand that some little attention is directed towards this question in the United States of America.

The Prussian Government in 1902 introduced a course of instruction for stokers, and in the Budget allocated £2,000 per annum for this purpose. The motives which induced the Government to ask for this grant are put

forward as follows: "The preliminary condition for the prevention of excessive emissions of smoke is, as experience has shown, the instruction of capable firemen. This would also have the advantage of leading to better insurance against boiler-explosions and to economy. In view of the general State interests which are here in question, and of the proven failure and insufficiency of efforts on the part of persons interested, it is desirable that the State should take the proper steps for such instruction to be given. By way of experiment, and for at least two consecutive years, itinerant courses of instruction will be instituted for firemen and engineers. The instruction will be given once a fortnight by academically-educated instructors paid by the State, according to a uniform system. . . . . In addition to the instructor a capable superintendent will give practical lessons. . . . . . In addition to this the Boiler Supervision Societies will employ firemen instructors, who will give the necessary lessons at the boiler and the engine to the firemen and engineers who are employed in country districts less developed industrially, and who cannot avail themselves of the courses of instruction that have been instituted."

In a document setting forth the principles according to which measures are to be taken in Prussian Stationary State Furnaces for the prevention of excessive emissions of smoke, it is directed that: "In order to avoid the annoyance and damage which may be caused by smoke from stationary furnaces, care should be taken in all works under State control that the emission of black, thick, and continuous smoke be avoided in the first instance by expert management of the fires, proper supervision over the firemen, and careful selection of fuel.

"The emission is to be regarded as continuous if black, impenetrable smoke proceeds from a chimney for more than five minutes without interruption.

"As far as is in any way feasible, care should be taken that only such persons as have satisfactorily managed furnaces for a considerable time shall be employed as independent firemen. If these persons have not gone through a satisfactory course at a fireman's school, opportunity should be given them as far as possible to attend one.

"The authorities who have furnaces under their superintendence should, moreover, see that firemen are instructed as to the cause of the emission of smoke, and that sufficient control is exercised over them.

"In choosing fuel the guiding principle should not, as a rule, be that the emission of smoke is to be prevented by the acquirement of expensive kinds of coal, or of coal that gives out little smoke without particular care, or by replacing coal by coke (except when the latter cannot be

dispensed with on account of the nature or object of the furnace); but rather that the fuel is to be obtained which is generally used at the works, even if difficulties in the way of preventing smoke are thereby incurred.

"If excessive emissions of smoke cannot be sufficiently prevented by careful management of the fires, supervision over the firemen, nor by the selection of fuel, without considerable increase in the cost of fire, a few furnaces should be provided with special tried appliances for the prevention of smoke in all places where this may be desirable in view of the situation of the works."

I am of opinion that, as regards the efficient training of stokers, we might well adopt some plan analogous to that inaugurated by the Prussian Government in 1902. However, I would substitute municipalities and county councils for the State, the more so that those bodies have already many facilities for the instruction and examination of candidates desirous of obtaining certificates of proficiency.

If instructional courses for stokers were instituted, and if employers would give a preference to those persons who had been properly trained and could produce documentary evidence of the fact, the result would go far towards mitigating the smoke-nuisance, and would, at the same time, effect an enormous saving of money now constantly wasted through the imperfect combustion of coal.

REPORT BASED UPON RETURNS FURNISHED BY MANUFACTURERS WHO HAVE SUCCEEDED IN SECURING

THE ABATEMENT OF SMOKE IN FACTORIES.

By SAMUEL RIDEAL, D.Sc.Lond., F.I.C.
(FELLOW.)

INQUIRIES, in the form of a circular letter issued by the Coal Smoke Abatement Society, were addressed in February, 1905, to 63 firms, in respect of whose manufactories or chimneys no smoke-nuisances had been observed for six months. For form of inquiries see schedule appended.

Of the 42 firms which replied, 38 supplied information and the other four invited a visit from the Society's officials, when any information would be supplied. Of the 38 firms which supplied information, 32 agree to the publication of their methods, while only 6 object. Three of the 38 have substituted *Gas Engines* for steam plant, leaving for further analysis the information supplied by the remaining 35 firms.

Thirteen firms mainly ascribe their success in preventing the emission of smoke, to *careful stoking.*

The following is a list of the various fuels used, supplied by the 35 firms:—

17 Firms burn Welsh coal only.
1 Firm burns Welsh coal and coke.
2 Firms burn Welsh coal and hard steam coal.
1 Firm burns Welsh coal and bituminous nuts.
1 „ „ Welsh coal and anthracite.
4 Firms burn anthracite only.
1 Firm burns anthracite and hard steam coal.
1 „ „ anthracite, coke breeze and small house coal.
4 Firms burn hard steam coal only.
1 Firm burns "good small coal."
1 „ „ bituminous coal.
1 „ „ coke.

Of mechanical devices for economising fuel, 18 firms supply the following information of the results of their experiments:—

		If economical.
1	British Fuel Economiser.	Yes.
2	Martin's Patent Smoke Consuming Door.	"
1	Perforated Furnace Doors.	" (fairly.)
1	Richard's Patent for Forced Draught. ...	"
1	Special Mechanical Device.	"
1	Tubular Fire Bars, supplying heated air to back of bridge	"
1	Edwin Coles' Furnace Door. Cuddy's Tubular Bars.	Not stated.
1	Johnson's Economiser and Smoke Consumer	Slight saving.
2	Chain Grate Stoker. (One, not successful with Electricity Generating Stations, the other not running long enough to form an opinion.)	
1	Induced Draught	Yes.
1	Steam Blower	No.
1	Automatic Air Louvres	Very.
1	Meldrum's Forced Draught and smoke Preventer	"
1	Meldrum's Forced Draught, do., do.	Yes.
1	Patent Venetian Fire Bars	Effective but extravagant of coal.
1	Venetian Rocking Furnace	Saves 10 % of fuel.

Two firms which have tried various mechanical devices, emphatically disclaim any benefit derived from them, and support the evidence of other firms in favour of careful stoking.

Two firms ascribe success to the high chimney-shaft giving an excellent draught, and one of them, in addition, to the fact that its boilers have been "set" with large flues.

One firm is abandoning mechanical devices in connection with boilers and steam engines, and is replacing them by electrical machinery, in the hope of effecting an economy.

It will be seen from these replies that though not denying the efficacy of many mechanical devices, yet the general consensus of opinion favours skilled and careful stoking as of the first importance.

QUESTIONS.

1. What description of fuel do you burn, Welsh, bituminous or coke?
2. What description of boiler do you use?
3. What mechanical device (if any) have you for preventing the issue of smoke from your chimneys?
4. Do you find the use of such apparatus or the other steps you have taken economical or otherwise?
5. Do you wish your communication to be treated as confidential?
6. Any other information or remarks?

Name of Firm . . . .

Address . . . .

THE ARTIFICIAL PRODUCTION OF PERSISTENT FOG.

By The Hon. ROLLO RUSSELL, M.A., F.R.Met.Soc.
(FELLOW.)

STANDING on the summit of the Malvern Hills early on a fine frosty morning, clear on the heights and with stratus at a much lower temperature on the plain up to about 200 ft., one may see here and there a column of factory-smoke rising for a little space above the fogbank and recoiling into the cold cloud from which it had for a moment emerged. The smoke, warm on its projection into the outer air, and lifted by hot gases, is able to penetrate the stratus, but is quickly cooled by contact with it and by radiation into the sky, and so takes its place in the recumbent horizontal cloud, condensing vapour upon itself and slowly sinking.

Soon, however, the sun pours his beams on the surface and evaporates the droplets of water, which gain more heat than they radiate, and the fog continues to dissipate from above downwards. In two or three hours it is gone, and the air near the ground becomes warmer than the layer above it, and rises. The smoke from the few factory-chimneys is incompetent to arrest appreciably the natural process of evaporation under the thermal work of the sun's rays.

Now take another situation in similar weather, and scan from Hampstead Heath or the Crystal Palace Water Tower the expanse over London. From 6.30 a.m. onwards a huge evolution of dark smoke proceeds, not only from hundreds of factory-chimneys, but from hundreds of thousands of kitchens. Smoke penetrates the fog through and through, it enters particle by particle into contact with existing spherules of water, and, owing to radiation into space, adds to the amount and darkness of the stratum by condensing upon itself the available vapour of the saturated mass. Sulphurous gases, hydrocarbons, and vapour resulting from combustion contribute to the mess hatched out of the cold cauldron of the London Basin, all conspiring, before the sun rises, to defeat his majestic rule. At sunrise the whole London area, cold, becalmed, shrouded,

has, up to 200 ft. or higher, a cloud of water-particles and smoke-particles copiously radiating heat to the stars and removing it from the air.

The growing sun-power of the early hours may succeed here and there in evaporating an unassociated water-globule; it fails to raise or carry off a smoke-particle, or a combined smoke and water particle, in which either the soot tenaciously retains the moisture, or, possibly in some cases, the fog-globule protects itself with an oily skin. The water-particles continue competent to radiate while protected against dissolution. They even fail for a long time to respond to the thermal orchestra which beats upon them, and which would call them to break up and stream into a higher region, for they radiate strongly upwards while defended by volumes of obstructive smoke eastwards from the nearly horizontal rays, already weakened by passage through many miles of dusty air near the dewpoint.

Sometimes the power of the sun, even in winter, may avail to dissipate a real London fog, but in typical radiation weather, with calm and pertinacious cold, the clearing of central London is rare; and with a very slight breeze, the clearing of suburbs to leeward is rarer still. The creation and maintenance of a London fog are the result of the inability of the lower air to rise. It is only during the conditions which give rise to radiation fogs that both wind and vertical circulation are inhibited, and therefore it is only on these occasions that the air in the streets becomes dense with smoke. We are cut off from the circulation of the great atmosphere.

The continual rapid growth of streets and houses in the area around the London of 1860 has had two effects on London fogs, one favourable to their augmentation, the other (and, I think, the more potent) favourable to their diminution. While the new houses add to the actual amount of smoke in the air, the increase to a very important degree of a dried and warmed surface, deprived of grass, has two consequences which work against the production of dense fogs. First, the formation of ground-fog is signally hindered. In old days, I always found the public parks to be the best breeding-grounds of dense, natural, ground fogs; and these fogs overflowing into the streets, would there somewhat diminish through contact with warmer surfaces and through obstructed radiation towards the sky. Warmed houses are in themselves unfavourable to stratus. Thus suburban London, with wide areas of warm dry surfaces, has to a great extent saved central London from the fogs which grew from the open grassy surfaces of hills and marshes which formerly surrounded us. Secondly, when fogs are formed, they have acquired through their enormity, or rather, through the immensely greater quantity of heat which they contain, the faculty of automatically setting in motion the machinery for their removal.

The amount of heat now liberated by the combustion of coal and gas within Central and Greater London enables it to accomplish important effects in circulation. The temperature of Central London on cold mornings is frequently from 4 to 8 degrees higher than the temperature of places ten miles outside in every direction. Consequently, a regular upflow of air, gases, smoke, and combustion-products generally takes place on every calm morning without fog, and on many calm mornings with fog; in fact, one may, I think, safely say on nearly every calm and fair morning, except with ground-fog or very low fog. Then circulation and horizontal inflow from the country follow. And, as we have seen, dense ground-fog is of necessity becoming increasingly rare at nights, owing to the spread of warm dry surfaces round the town. In the daytime, even twenty-five years ago, I noted a gentle inflowing current round Central London in a dense fog. Thus we find that the conditions favourable to severe continuous fogs in London have become less and less likely to occur, and that the dark radiating stratum of fog and smoke is frequently now raised some hundreds of feet above the streets. With a slight breeze this dirty cloud is carried to the country and descends nearly to the ground at a distance of ten to thirty miles, often actually increasing in density as it cools.

Yet we must remember that a spell of calm radiation weather, with prevailing great cold and fog in the country, is still competent to produce very dense, persistent, dark fogs in London, and that these fogs may be destructive to human life. A certain intensity of radiation, depending on the dryness of the upper air, and a certain depth of low fog, depending on the character of a lower current and the degree of cooling to which it has been subject, will enable the smoke retained near the ground to shut out all sunshine, and to produce a sooty stratum noxious almost to the point of suffocation.

Conditions have not occurred for some years past which allowed the long maintenance of the worst, the most life-endangering fogs, but they are sure to come soon. The most disastrous in my experience (and I have pursued some of the very worst) have belonged to a period distinguished by brilliant weather in the country, or else to persistent radiation-fogs with very low temperature at night. The darkest days in London have been the brightest outside the town-influence. Two out of three of the darkest, when the blackness of night was reached, were on Sunday and Christmas Day, so that factories are proved not to be the chief offenders. The multiplication of dinners explains the excess of fog on Sundays in winter.

Wet fogs, due to a moist general air and to conflict of currents near the ground, and not to radiation, are invariably less dense in London than in the country. When the trees are dripping continuously, London usually gives to the incomer from the country a pleasant surprise. With a cloud-canopy overhead the smoke is not retained near the ground and does not gather moisture: the air over the town is warmed and dried above the dewpoint.

It is radiation which above all maintains a particular London fog. In several previous papers I have recorded facts showing that fog and haze are very largely dependent on different currents in the atmosphere. Increasing cold, calm, and radiation, with a difference of winds, shown by high and low clouds, are signs which ought to be taken as warnings that fog may easily develop. Conversely, an approximation of currents leads to the dispersion of fog. So does an extension not only of visible cloud but of a moisture-laden air through the upper strata, between the middle cloud and the upper cirrus level.

Observations made in Baden some years ago showed that during anti-cyclones the air at a high level is unusually transparent. And a large number of automatic balloon observations, recently classified, testify to the uncommon dryness and warmth of the upper strata over areas of high pressure. Conversely, the high air over cyclones is moist and cold, capable therefore of reflecting the warmth of the earth, and preventing rapid loss by terrestrial radiation. Hence transparency near the ground.

It has been suggested that, since mere combustion results in the projection of a very large volume of dust-laden gases into the air of London, and since vapour-precipitation takes place only on solid particles, many of which are microscopic, therefore we shall be subject in London to an excess of fog, whatever the fuel which may be burnt. It has been argued plausibly that the very fine invisible dust produced in countless millions from every gas-jet, will be competent, no less than the smoke-particles from our kitchen-chimneys, to maintain the excess of London fogs.

Now I do not know that theoretically we have the data on which to disprove this proposition. Fine, invisible dust has been shown in the laboratory to be capable of producing fog by precipitation of vapour on cooling. The dustless bell-jar remains free from fog.

On the other hand, we have the overwhelming evidence of experiments on a large scale against it: the evidence of the districts of anthracite coal, of towns where wood is burnt, of towns where oil or oil-gas is burnt, of towns where charcoal and gas are burnt, that no excess of fog affects these places. In an excellent test case, that of Pittsburg, coal-smoke

caused much darkness and fog-cloud. Then coal was superseded by oil-gas, which freed the city from obscuration. Then, after some years, I think, coal was largely used again, and dark fogs recurred.

The mistake of imagining artificial fine dust to be a fog-producer like coal-smoke, has arisen probably from leaving out of consideration the fact that the lower air has nearly always sufficient natural fine dust to allow of vapour-precipitation in favourable conditions; so that a great excess of fine artificial dust is not required for the formation of a stratus cloud. Fog forms wherever there is unusual radiation, calm or light airs of different temperature, saturation, and increasing cold. It finds points of condensation enough in the neighbourhood of the ground; and, even at great heights, clouds follow a small reduction of temperature or contact with a colder current.

But the smoke of sea-coal has additional qualities which enable it to gather and retain moisture, and, where very abundant, to prevent the warming of the earth while defending its own mass from the sun's rays. Lamp-black or soot is the most effective of radiators and absorbers of heat. And we have above all to remember that coal-smoke makes a fog by itself, as in a room, while gas and clear-burning wood make no visible fog.

A dense smoky mist would be produced by the mere conditions which allow the natural ground fog to exist, even if that fog were removed. The smoke is caught and retained by the air over large towns as completely as if the town were covered by a roof of the height of the stratus, one to two or three hundred feet. Imagine a room twenty feet square and two hundred feet high, into which a coal fire poured thick smoke for an hour. At the end of the hour the air throughout this tower would be choking thick with smoky particles; there would be a small London fog without the moisture, and a brilliant light in the roof would hardly pierce it. No doubt the proportion of smoke to air in the open spaces and least thickly inhabited parts is less than in the above example. But the height of a fog is often less than two hundred feet, and the number of hours of thick smoke effusion is more than one. Nearly the whole of the products of chimneys, after two or three hours of emission, are sometimes concentrated within a hundred feet of the ground. If the ground has been very greatly chilled by previous frost, the mass of lower air, moisture, and smoke clings tenaciously, like water under oil, to the neighbourhood of the earth, so that beneath a clear sky the combined heat of the sun and of the combustion products of thousands of tons of coal within London may be incompetent to disperse the fog.

When there is no fog at all, but a clear sky before sunrise with frost,

as, for instance, on Nov. 21st, 1905, the smoke may remain for some hours in the streets and up to a moderate height, making the sun invisible and the air unpleasant to breathe. With a dense fog, the smoke is more concentrated, and the effects more severe.

In one of the great fogs of 1880, the depth of the stratum (formed by a south wind moving over frozen ground) was only about thirty feet in Belgravia and Knightsbridge, and the density was such that drivers could not see half across the road. This was a rare case; the fog was white owing to the escape of the smoke into the clear, warm, upper air. In a similar fog early one April at Portsmouth, extending to the Isle of Wight, the topmasts of steamers were in sunshine, but the captains refused to make the passage during the whole morning.

These are clearly not fogs artificially generated or prolonged, nor can they be reduced. But they are naturally not of long duration.

Dark fogs of long duration are preventable simply by the reduction of the visible solid impurities cast into the air by the process of combustion. Good results are obtainable by the use of anthracite-coal, gas, or wood, by the careful combustion of ordinary coal (that is, by good stoking in proper grates and furnaces), and by the substitution of radiators or hot-water pipes for separate fires in large houses. There can be no question that this last system, even now, in the big hotels and clubs, saves a great deal of trouble and dirt, and adds greatly to comfort by abolishing chilly rooms with their sources of air-pollution. But many of the kitchens of hotels and clubs are among the worst offenders in the production of black smoke.

The chief problem for immediate practical purposes is the preservation of the cheerful open fire of sitting-rooms, including many kitchens, without the production of much smoke. Improvements in grates and a more scientific feeding of fires by housewives and housemaids would lessen the nuisance considerably; but scientific training seems still to be a long way off from the purview of the directors of education. At this moment, however, I see a programme of the Education Committee of the Surrey County Council which opens up a vista of practical training for domestic utility, with a proper regard for personal and general welfare. Although civilization has existed for thousands of years, we of Western Europe have hitherto almost wholly neglected the science of the amenity of daily life, and scarcely a child is taught how to feed economically, and therefore with most benefit, either its own body or a coal-fire. Regard for neighbours and for the whole community, as well as for the productive work of the family, would counteract the present wastefulness which we see in all directions, and even among the poor.

A combination of the close stove and open fire has great advantages. The close stove warms a room at least one-sixth more per pound of coal than the open fire of the best construction, and is capable of burning anthracite easily, a fuel which gives one-eighth more heat than ordinary house-coal.

Possibly the more general introduction of heating gas may precede the extension of house-science to the schools. Gas has the advantage over coal of being always obtainable without trouble, and without the heavy traffic of coal-wagons, which add to the blocking and wearing of streets. More general cooking by gas is already beginning to purify the London air from the domestic side, and the legally enforced improvement in factory smoke consumption has had a decided effect.

It has not been sufficiently realized that by far the greatest volume of dense smoke is produced by the ordinary way of lighting fires, during the first hour of ignition. If the coal could be made to kindle without dense smoke, London fogs would be deprived of their worst qualities. At forty miles distance from London the smoke brought to the country by the wind is much more dense in the first hour of arrival than later. It represents the hour of kindling.

The additional sun-warmth obtainable by the diminution of dark smoke may be inferred from the statistics which show that in winter London has less than half the bright sunshine of inland stations, and little more than one-third of the sunshine of stations on the south coast.

The average daily consumption of coal in London on cold days in winter is about 50,000 tons. We may take 10,000 tons off this amount to allow for the heat converted into other forms of energy.

The experiments of Fabre and Silbermann showed that the consumption of 1 lb. of coal produces heat sufficient to raise nearly 8,000 lbs. of water 1° C., or, I suppose, roughly, to raise 80 lbs. of water from the freezing to the boiling point. The burning of 40,000 tons on a winter day in London is thus sufficient to heat 3,200,000 tons of water from 0° to 100° C. Thus a lake 1 ft. deep and with sides 1¾ miles long, occupying 2,500 acres, would be heated from 0° to 100° C.

Otherwise stated, and more to the purpose, 1 lb. of coal would heat 396,000 cubic feet of air at the ordinary temperature 1° C.; 1 ton of coal would heat 887,488,000 cubic feet 1° C.; and 40,000 tons would heat 35,499,520,000,000 cubic feet 1° C. Roughly, this quantity of air warmed 1° C., or 1·8° F., occupies a space equal to that contained in a layer 1 ft. deep and 1,140 miles square, or equal to a layer 10,000 ft. deep and eleven miles in the side square. Or a layer 5,000 feet deep and eleven

miles square, that is 121 square miles, would be raised 2° C. or 3·6 F. This area, I think, nearly corresponds with the area of London. Thus, during one hour, about $\frac{1}{16}$th of the time during which fires are alight, a layer of 312 ft. deep would be heated 2° C. Half of this rise may be deducted for the heat used in warming the interior of buildings, and in other ways, so that we may safely take 150 ft. as the depth of the layer which would be heated 2° C. in one hour. But the effect would really be greater, on account of the permanently higher temperature of the house- and ground-surfaces in London, probably at least 3°, in winter months, above the ground surface temperature in the country. A comparison of the temperature at Old Street with the temperatures in the neighbouring country, as recorded in the Meteorological Tables for the last three months of 1904, shows an excess of 2 to 4 or even 5 degrees on cold mornings at 9 a.m. Moreover, the very large emission of vapour in combustion increases the lightness of the lower air.

Owing to the unequal distribution of houses and chimneys, and to large open spaces, the probable actual effect in moderate fogs would be that gentle up-draught columns of air and smoke would form over many separate places, in the manner of the invisible columns of smoke which create cumulus clouds. Thus part of the fog would often be carried up and away.

In dense, low fogs, with very rapid radiation to a clear sky, the loss of heat by the smoke and warmed air would be too quick to allow of the ascent of quantities of warmed air, and the fog would remain dense in a calm atmosphere throughout the day. When the layer of clear air above the fog is five to eight degrees warmer than the stratus, as it often is, there is obviously no ascensional energy available to remove the fog.

In some cases, with a layer of cold air, or a very low stationary cloud a few hundred feet above us, the smoke and warmed air would ascend to a level somewhat higher than the top of St. Paul's, and would then be caught by the cold stratum, causing great darkness over the city. This condition is becoming more frequent in London.

We must still expect the maxima of cold fogs to coincide with the maxima of smoke-retention, involving danger to health and life, although the frequency of moderate smoky fogs seems likely to diminish.

The most important immediate problem requiring solution is the easy kindling of fires with little smoke and careful stoking, and economy in fuel of the right sort.

ON THE DESTRUCTIVE EFFECT OF SMOKE IN RELATION TO PLANT LIFE.

By ARTHUR RIGG,
Member of Council, Royal Botanic Society of London.

THE joint Committee of the Coal Smoke Abatement Society and The Royal Sanitary Institute, having requested that some representative of the Royal Botanic Society should read a paper at the forthcoming Conference on the above subject, the Council of the Royal Botanic Society have requested me to perform this part, and I trust to be able to add something of interest to your proceedings.

The subject arose out of remarks in the *Westminster Gazette* on the evil consequences of black smoke to the plants belonging to the Royal Botanic Society. It has, however, been again and again before the Society, and no further back than 1880 Mr. Sowerby says: "Plants cultivated in London suffer at all times and seasons more or less from the dull atmosphere, charged as it is with smoke, and the unprecedented amount (in January, 1880) and duration of soot-charged fog which during many consecutive days hung over the Gardens, prevented the sun's light from reaching the plants, and thus retarded their healthy development. In some cases flower buds have fallen, without coming to maturity; in others unnatural and sickly growth has been the result, and this especially at the greenhouses, the lower natural temperature of the open garden keeping the plants and trees generally in a state of sleep or rest, in which the action of light is not so essential to their vitality."

So far as London is concerned, there seems to have been no appreciable improvement or reduction in the number of its fogs, or their density, during the 25 years since that complaint was written, and the evergreens, with other plants, are still crusted as thickly as ever with a black slimy product which comes down as fog. So damaging is this mud to the plants, that it becomes necessary to keep washing their leaves, and it may be taken as a general rule that a London garden costs twice as much as a

country garden of the same size, and this is entirely due to fogs and their constant companion smoke. Indeed, it is noticeable that West End gardens lose much of their due amount of sunshine owing to the pall of smoke (even when there is no fog) that sunlight cannot penetrate, until high noon has passed, and the afternoons in West End gardens get far the largest amount of life-giving sunlight.

In considering the evil effects of coal-gas, when burnt, upon the life of plants, and no doubt of animals also, it should be remembered that the carbon produced by imperfect combustion does no direct or poisonous harm, but it closes up the pores of the leaves and prevents the performance of their proper functions.

As there is much sulphuric acid in the substance of the fog, it follows that a poisonous action takes place, whereby plants are greatly injured: it is, therefore, very desirable that there should occasionally be a good top dressing of the waste plaster of houses and ceilings, being pulled down, or lime where this cannot be got. This applies to window-box gardens, and to gardens of every size. Those plants which flower near the ground, such as pansies, suffer most from the poisonous surface of the ground, and no plants can be found which are in any way the better for the conditions under which they have to grow in a London garden.

In order to get some idea of the amount of smoke or other items which fall upon the leaves of an evergreen plant (the aucuba), a quantity has been gathered and carefully washed. The difference in appearance of washed and unwashed leaves shows the extent of this evil, and it is no wonder that such a deposit damages the plants that carry on a precarious existence in a London garden. The general consistency of the mud-laden water approximates if it does not exceed that of ink.

In order to learn which plants or trees can live or cannot live in London, as compared with a different climate, namely, that of his estate in Ireland, Mr. Marlay has been making, during many years past, a series of experiments, and the results he has most kindly supplied to the author, who has thus been enabled to publish an extremely interesting comparison. It is curious to note that some plants, as for example the white oak (Quercus alba), will flourish in Regent's Park better than in Ireland, where it enjoys apparently the finest conditions.

It must be remembered that London has variations of climate and more than one soil, and that fogs, into which soot and sulphur largely enter, are prevalent during a great part of the year, Of trees generally, especially deciduous ones, such as the plane, several forms of acer, poplar and birch, will live fairly well in London atmosphere. The

scarlet oak, introduced by Mr. Marlay, has surprised him by its success up to the present.

In regard to common wild flowers, we must not expect to grow these with the same amount of success as we can do in a purer air.

Most evergreen shrubs are very doubtful, and the pine tribe may be given up. Some evergreens will thrive well for a certain time, the aucuba and broad-leaved holly being the best; others will struggle on like the yew and box, for varying periods, but are of no use except in carefully tended gardens.

Fruit-trees might be tried in London on a more extended scale than at present. The experimental garden belonging to the Royal Botanic Society shows very interesting examples of vegetable and fruit growth.

In conclusion, it can be taken as a general rule that all trees or plants with smooth leaves can better resist the action of fogs than those with rough or hairy leaves, such as the foxglove, salvia, and common primrose. These and others of their class suffer the most injury.

So far as plants under glass are concerned, similar conditions prevail, affecting such plants as, for instance, the Chinese primula and cineraria.

In all cases, however, it is necessary to keep the glass clean by washing after the occurrence of fog.

AIMS AND WORK OF THE HAMBURG SMOKE ABATEMENT SOCIETY.

By JOHN B. C. KERSHAW, F.I.C.

NEARLY everyone agrees that smoke means loss of money both to the individual producing it and to the individual whose house, lands, possessions, or person are damaged and blackened by its later descent in the form of smuts, sulphurous vapour, and black fog. There is, consequently, no need to discuss the health or economic side of the smoke problem. What we have gathered here to discuss is the more practical and useful question, to what extent is smoke-abatement possible *now*, both as regards the manufacturing and domestic use of coal? To-day we deal with the subject of *Factory and Trade Smoke.* I am not exaggerating when I state that four-fifths of this is produced by the unscientific conditions under which coal is used in the furnaces of boilers and other heating appliances.

The recently published Report of the Royal Commission upon our coal-supplies, contained the startling statement that of the 150 million tons of coal used annually in this country, an economy of from 40 to 60 million tons, or over 33 per cent., was possible by greater attention to the scientific principles of fuel-combustion. The Commissioners also stated that about 52 millions of tons of coal were used annually for steam-raising purposes, and that the average consumption per h.-p. hr. was about 5 lbs. When one compares with this figure the actually recorded consumption of 1·3 lbs.* per h.-p. hr. for marine engines, one sees what an enormous waste of fuel is now occurring, and what scope there is for the organized attempt now being made to obtain a more scientific use of fuel in our manufacturing industries. This paper will deal with a practical branch of the subject:—namely, the methods of voluntary supervision and control adopted in Hamburg for obtaining greater efficiency and less smoke from the factory-boiler installations in that city.

It is somewhat striking that this example of what can be achieved by voluntary effort, should come to us from Germany, the land of bureaucracy

* SS. Saxonia trials in 1902.

and State control. The *Hamburg Verein für Feuerungs-betrieb und Rauch-bekämpfung* is, however, an entirely voluntary organization of steam-users, and its members are only bound together by the common desire to obtain greater efficiency and less smoke from their steam-raising plant. The Society has now been in existence three and a quarter years, and the following account of its organization, aims and work is drawn from an explanatory pamphlet and from the two annual reports which have been issued since its inauguration in October, 1902.

The work of the Society is controlled by a committee of six to nine members, elected annually. The technical and scientific work is undertaken by the staff of experts retained by the Society for this special work. At the date of the last report this staff consisted of a chief engineer, two assistant engineers, two instructors for firemen, and one clerk, while for special steam-raising and other trials, three additional assistants had also been employed. The chief engineer attends the committee meetings and takes part in the discussions relating to the work of the Society. The funds of the Society are drawn from three sources:—From the annual subscriptions of its members; from payment for special work and reports for its members; from payments for outside work.

The Society is thus entirely self-supporting, and its success is dependent upon the value of the return it makes to its members for their contributions and fees. It is therefore gratifying to note that the membership shows steady growth. Starting with a few members in October, 1902, the register contained 60 firms and 249 boilers at the end of September, 1903, and fifteen months later these had increased to 115 firms and 351 boilers. The report for the year 1905 is not yet published, but I am informed by the chief engineer that the membership is now 150, with 420 boilers under their control.

The objects of the Society, as set forth in the rules, are the attainment of the highest possible efficiency from the heating and boiler plants of its members, with the least possible emission of smoke. To this end, regular examination of these plants and of the methods of working them is undertaken by the expert staff of the Society, and suggestions are made for improvements when such are required. The education and control of the firemen in the proper performance of their duties, are also undertaken by the fireman-instructors on the staff of the Society. Comparative tests of fuel, and tests of smoke-prevention and other appliances of a similar character, are also carried out by the expert staff, and the results are circulated amongst the members of the Society.

Members of the Society can demand that their boiler or heating plant

shall be regularly inspected, and that its working shall be tested and reported on, at least three times a year. They have also the right to consult the chief engineer of the Society regarding improvements and alterations in the design and working of their plant.

They on their side are bound to allow the chief engineer and other members of his staff free access to their heating and boiler plant at all times, and are bound to make the necessary provisions for conducting the tests. They are also required to carry out the suggestions made for improving the efficiency of the plant, especially as regards the *abatement of smoke*, and to submit to the chief engineer all plans for extension of the plant, or for change in the methods of work.

Each boiler or heating plant, when brought under the control of the expert staff of the Society, is tested at the earliest possible date, and a written report upon the results of the examination is submitted to the owner. Should the firing have proved inefficient, one of the firemen instructors is sent to the works to give practical instruction to the firemen employed there, and tests of the plant are made at intervals until this fault is remedied. Defects in design are similarly dealt with.

The annual subscription to the Society for members without any boiler or heating plant, is 20 marks (£1). Members having boilers or furnaces which they desire to place under the control of the experts of the Society, pay a further 20 marks annually for each boiler or furnace.

The extra charges for tests and reports are based upon the time spent upon them and the number of experts employed. Engineers are charged for at the rate of 20 marks per day, and firemen-instructors at 5 marks per day. Special reports upon patented appliances are charged for at the customary rates; members receive a special discount of 30 per cent. on these, as compared with outsiders.

Turning to the work of the Society as set forth in the two voluminous reports which have been issued, one finds that the greatest stress is laid upon the improved efficiency obtained by the instruction of firemen in the proper performance of their duties. This corroborates the view held by many authorities in this country, that improper methods of firing are largely responsible for the smoke-problem. Up to October 1st, 1903, 120 firemen had been specially trained by the officers of the Society, and by December, 1904, this total had been increased to 300. As evidence of the loss in efficiency of steam-raising plants, due to this one cause alone, the following figures are given in the earlier report:—

Thermal efficiency, with the regular but untrained stokers	66·6 per cent.
Thermal efficiency of same plant, with trained stokers ...	72·7 „

In the plant where these tests were made, this loss of 6·1 per cent. in the fuel-efficiency represented a loss of 34s. per day, or £10 per week of 144 hours. In another test the loss due to the use of untrained stokers rose to 16·1 per cent., the thermal efficiency being increased from 66·8 per cent. to 82·9 per cent., by mere change of the firemen working the plant.

In this connection the engineer of the Hamburg Society wisely emphasises the fact that the attempt at *smoke-abatement* by untrained stokers, without scientific supervision, generally ends in failure; for their plan is simply to allow air in enormous excess to flow through the furnaces, which means great losses due to the heat passing away up the chimney, and high fuel-costs per pound of water evaporated. The highest tests given in these reports show heat losses from this cause amounting to 27·4 per cent., or over one-fourth of the heat-value of the fuel burnt.

The other branch of the Society's work (namely, alteration in the design and methods of working of the plants under their charge) is also dealt with in these two reports, and the following shows the improvements obtained by the systematic and scientific control inaugurated by the Society, in place of the haphazard and rule-of-thumb methods which had preceded this, in the boiler-plants dealt with :—

		Heat Loss in Chimney Gases.
Plant No. 1, consisting of five Lancashire boilers	First test	... 25·6 per cent.
	Second "	... 16·6 "
	Third "	... 19·3 "
	Fourth "	... 18·0 "

The saving here represented 11·9 per cent. on the fuel actually used.

Plant No. 2, consisting of two Lancashire boilers with inclined underfeed stokers	First test	... 20·0 per cent.
	Second "	... 10·7 "
	Third "	... 12·0 "
	Fourth "	... 11·4 "

The saving here represented 13·2 per cent. on the fuel actually used.

Plant No. 3, consisting of two water-tube boilers	First test	... 19·8 per cent.
	Second "	... 12·2 "

The saving here represented 9·7 per cent. on the fuel actually used.

Plant No. 4, consisting of one marine-type boiler	First test	... 19·6 per cent.
	Second "	... 7·9 "

The saving here represented 17·4 per cent. on the fuel actually used.

In these test-results, the first represents the original trial under the ordinary conditions of working; the second represents the results obtained when the plant had been altered on scientific lines and was worked by the expert staff of the Society; while 3 and 4 represent the results obtained at some later date, when the plant was again under the control of the ordinary stokers and boiler engineer attached to the works. The efficiency in this case had fallen back slightly, as might be expected, but was still much better than in the original test.

Limit of space will not allow more detailed figures of tests to be given from the two reports of the Hamburg Society, and those interested are referred to the original pamphlets. The following summary from the Report for the year 1904 will show, however, the activity of the new organization:—

During the fourteen months ending December 31st, 1904, 32 installations were submitted to the first thorough examination and test, and 71 firemen received instruction in their duties at these plants for a period of 175 days. 74 installations were visited for the second, third and fourth time, and in connection with these visits 190 tests were made, as a check upon their continued good working. The number of reports issued from the central office in connection with these and other tests was 226.

As a proof of the position which the Society has attained in Hamburg and Germany, it may be stated that a sum of £300 was granted to it in 1903, in order to carry out some special steam-raising trials, and a central model boiler installation was erected in Hamburg for this work. One hundred and thirty complete steam-raising trials have been made at this model boiler plant during 1904, and the results obtained are to be circulated amongst the members of the Society in a special report. A summary of the results of these trials is contained in the report for the year ending December 31st, 1904.

The practical lesson which we in this country may learn from the above account of the work of the Hamburg Society, is, I think, that the smoke-problem is to be solved, like many another problem, by application of that old English method of *self help*, which is now sadly out of fashion. Manufacturers, and fuel-users generally, in this country, must be taught that the emission of black smoke is largely preventable, and that the smokeless combustion of fuel *promotes economy*, when carried out under proper supervision. It is for this reason that the writer has given instances from the annual reports of the Hamburg Society to prove the saving in fuel-consumption which results from the working of steam-boiler plants on scientific lines, with properly trained stokers.

What is wanted in this country is some society or organization which will provide fuel-users with the technical advice and oversight required for obtaining the smokeless combustion of fuel in their own works. The Hamburg Society, in the author's opinion, is such an organization, since it is showing manufacturers how to combine together to attack the evil at its source, namely, the boiler and heating installations in their own works. It would be well if similar societies were started in every large centre of manufacturing industry in this country. The writer, as foreign corresponding member of the Hamburg Society, will be pleased to give all the information in his power, relating to the organization and work of the Society which he represents here to-day, and of which he has given a brief account in this paper.

ON PRECAUTIONS NECESSARY FOR MAKING RELIABLE OBSERVATIONS ON SMOKE DENSITIES.

By JOSEPH W. LOVIBOND.

IN dealing with the nuisances arising from the consumption of fuel, the subject naturally falls into two divisions, the avoidable and the unavoidable; in reference to the former I was asked by the Coal Smoke Abatement Society to design an instrument capable of measuring and recording the density of smoke as it issued from chimneys.

In designing such an instrument certain conditions must be complied with to make the readings reliable, namely:—All observations must be made under similar conditions. The light used for comparisons must be uniform in character. In the scale of standards used for matching, the divisions must be equal, and the unit recoverable.

It will be shown how these requirements are met, whilst describing the instrument, after considering the principles on which it is founded.

The foundation rests on the Tintometer equivalent colour-scales, which have the power of matching and recording in quantitative terms the colour-sensation excited by any substance.

Under this system the most complex colour can be qualitatively described by means of two colour-terms and one light-term, and when these are associated with their unit-values of intensity, the description becomes quantitative.

The order in which two colour-terms are associated is natural and invariable, they are always adjacent in their spectrum-order, red and violet being considered adjacent for this purpose.

The light-term is one of degree, representing a definite degree of luminosity between the extremes of the white light used for comparison and its total absorption.

The equivalent colour-scales are correlated to some chemical colour-constants, and therefore have a physical basis by means of which their truth can be tested. They have been adopted by some international

societies, and are used in many industries; a detailed description of their construction is given in my new work on "Colour Phenomena."

The photographic energy of the colour-rays, separated by the standards, was shown in a negative, taken from a screen made up of the glass standard-colours; the light used was equal to the absorptive value of the glasses, therefore the separated rays were free from the admixture of white light.

In the past some uncertainty has existed concerning the relation of colour-increase to density-increase, some considering that they were in direct ratio, but up to the present no such instance has been found, and it may be accepted that each substance or condition of substance has a rate specific to itself, which when once established can be tabulated and charted in curves furnishing a means of identifying that substance or condition of substance in future. The difference between the curves of the direct rate theory and those of the specific rate obtained by actual measurement were shown side by side on a chart, dealing with the differences between two makes of neutral tint glass; the density-increase was obtained by the successive superimposition of equal thicknesses.

A single colour-measurement is only the statement of an isolated fact, which although useful for many purposes cannot alone be relied on as a means of identification; it may even happen that two dissimilar substances coincide in colour at one point, they will however always diverge as their densities recede from that point.

The instrument is a pocket edition of one used for measuring the colour of landscapes, gases, and incandescent bodies. It consists of a rectangular tube 1½ inches by 1 inch section, 4 inches long, one end is closed except a circular ⅛ inch opening used as an eyepiece. The purpose of the tube is to cut off disturbing side-lights, which never equally affect two colours placed side by side, as when matched without this protection a change of position will certainly disturb it.

In the middle of the tube is a diaphragm having two ⅛ inch square apertures half an inch apart; one is intended to command the smoke to be measured, and the other is filled with a beam of diffused daylight for comparison; the object of the ⅛ inch openings is to limit the field of view to the area of smoke under observation.

At the open end the base is prolonged two inches, forming a stage to carry a reflector, which consists of a slip of Chance's matted white opal glass fixed at an angle of fifteen degrees with the prolonged stage. This collects the light from a large area of overhead sky, reflecting it to the eye through one of the apertures as a beam of diffused daylight; this

overhead light is necessary, because light taken from the altitude of chimneys is too variable for reliable work. Fifteen degrees is found to be a suitable angle for the reflector, and is adopted for all this class of instrument in order that their readings may correspond.

The standards are slips of neutral tint glass sliding in grooves on one side of the instrument, intercepting the beam of diffused daylight and reducing its luminosity according to the absorptive value of the glasses themselves, which had previously been correlated to the equivalent scales; each glass and each combination is separately measured, and their values inscribed on the top of the instrument in neutral tint units for ready reference. When a smoke is matched its density is recorded in units of white light absorbed; the values for No. 11 instrument are as follows:—

Glass Combinations.		Light Units absorbed.
No. 1	= ...	3·9
„ 1, 2 ...	= ...	6·8
„ 1, 2, 3 ...	= ...	9·6
„ 1, 2, 3, 4 ...	= ...	12·5
„ 2	= ...	1·35
„ 2, 3... ...	= ...	4·0
„ 2, 3, 4 ...	= ...	6·6

The photographic evenness of the neutral tint scale of equivalent colour-combinations was seen in a negative from a screen made up from the glass standard scales.

Different makes of neutral tint glass vary both in colour and rate of light-absorption, making it necessary to establish the rate of each sample for the purpose of selection; a rate is established by measuring a single slip, and then successive additions until all light is absorbed. The results are tabulated, and the curves established, as in the chart, where the ordinates correspond to the units of the colour-scales and the abscissæ to the number of superimposed glasses.

It will be noted that two makes of neutral tint glass are used in this case, one marked series 9, and the other series 30; this is because the free colours in the working part of the scale of series 9 are blue and green, while those of series 30 are yellow and orange. These colours naturally neutralise each other, making their combinations more neutral in tint than combinations of either series alone, the mixture is, therefore, better adapted for matching smoke.

One precaution is imperative, no direct sunlight must be allowed to impinge on the reflector, the reason being that measurements made by

diffused daylight agree with the test conditions for uniformity, whilst those made in sunlight do not, they also vary with every variation in sunlight intensity.

The reason of this variation is influenced by at least two contributing causes: first, direct sunlight is yellow-orange in colour and is therefore differently affected by two dissimilar bodies; second, direct rays are in a different condition and give rise to a different set of colour-phenomena from those caused by the same light after diffusion.

Smoke-density when recorded in units of white light obstructed is a reliable index of bad stoking, recording as it does the visible part of the nuisance, but takes no notice of the distilled gases which always accompany imperfect combustion.

In order to apply the colorometric test to the gases given off by the imperfect combustion of different fuels, an apparatus was constructed consisting of a furnace with a chimney surmounted by a chamber having a series of sinuous surfaces over which a continuous stream of water flowed, meeting the smoke in its upward course. The following fuels were experimented on and the specific curves of their smoke-solutions plotted on a chart, the wide variations indicate variations in constituents.

No.				No.			
1	Coal Gas Smoke.			8	Steam Coal Smoke.		
2	Anthracite Coal Smoke.			9	Beech Wood		,,
3	Carmel	,,	,,	10	Ash	,,	,,
4	Birley	,,	,,	11	Pitch Pine		,,
5	Newbury	,,	,,	12	Elm	,,	,,
6	Braysdown	,,	,,	13	Oak (seasoned)		,,
7	Norton Hill	,,	,,				

THE EFFECT OF SMOKE ON PLANT LIFE.

By Miss M. AGAR.

FROM experience in working as landscape-gardener to the Metropolitan Public Gardens' Association I have been asked to say something about the effect of smoke on vegetation.

Soot is the chief enemy to vegetation. The finely divided particles of carbon which constitute soot settle in masses as smuts, or drift about, invisibly small, and become evident as a deposit. They penetrate into the pores of plants and interfere with all functions of the leaves; with transpiration of water-vapour, and with inspiration of air. Unless transpiration is freely allowed the sap can circulate but sluggishly. Unable to get rid of water no more can enter, and the passage of food-materials from the root is checked; and unless air, with its supplies of oxygen and of carbon dioxide, can enter, the plant suffers starvation in that direction also. Indeed, were it not that a plant's stomata are almost entirely on the under sides of the leaves, no plant could survive a London fog.

Everyone has noticed how quickly the colour of paint deepens in town. The emerald-green of newly painted Westminster Bridge in a few weeks is a sober, olive hue. Consider what a deposit that so darkens colour must be to a plant which depends on light for all its chemical processes. Every dirty plant is living practically in twilight. About once a week, during the winter months, the plants in the little garden of the Bank of England, are *hand* washed, as one washes room-plants, with soap and water, otherwise they would hardly appear green. After a spell of foggy weather I have seen the leaves iridescent with a tarry film, so greasy is the soot. Of course, hand-washing is out of the question in large spaces, and one has to fight this evil of dirt by planting only such things as have shiny or smooth leaves, on which soot cannot get too firm a hold for rain to partially dislodge it. Even so they are but sickly specimens, and in all cases the lower leaves tend to drop off prematurely, owing to their receiving a double portion of dirt in drips from above. London shrubs rarely "break" from below; the stems are too coated for young life to get through.

Another method of helping the plants is to give liberal root-feeding. They must be stimulated to make the most of every clean breathing space and produce fresh leaf-surface whenever possible.

I have mentioned smooth leaves as an essential qualification for town-plants; a deciduous nature is also an advantage for obvious reasons. The plane goes one step further and sheds its bark too. I know one sees evergreens as often, if not oftener, than deciduous shrubs in London, but that is because planting is done for purposes of privacy as much as for beauty. The ivy edging in the Grocers' Hall garden *is* somtimes deciduous, as though it realised the virtue of such a habit. After last winter, which was a particularly black one, it shed all its leaves and started fresh. The leaves that came away were more like black suède leather than vegetation.

No conifers, except the gingko, which is hardly recognisable as a conifer, can thrive in smoky atmospheres, everything is against them. They are evergreen and their bark is rough and frequently resinous: conditions which cause their final suffocation from dirt. It is sad to see the fine cedars in the Holland House gardens dropping their lower boughs and yearly looking more wretched. Years ago there were fine cedars in Fulham; they have nearly all disappeared, and the names of houses and roads are their memorials.

Another character must be taken into consideration when experimenting with shrubs in London, the season at which growth starts. Late shooting things are more likely to thrive than those which bud early and have their young leaves exposed to the fogs and dirty air of the season of domestic fires. The plane again shows its suitability for town-life by its slow start into leaf; the catalpa and ailanthus are good trees for the same reason.

Not only has soot a directly baneful effect on plant-life, but it also attacks plants through injuring the fertility of the soil. The fine particles settle in the interstices, and make it impervious to air, and, without air, soil soon sours. The fertility of the ground depends on bacterial activity, and whether or not soot is a poison to these organisms I know not, but certainly a lack of air is fatal. Ordinary London soil is sadly unfertile; we have always to bring in fresh soil to revivify it, and I imagine that the chief virtue of the new soil is, that it inoculates the old soil with fresh germ-life. Possibly manure serves the same purpose in addition to its obvious one of supplying plant-food, and improving the mechanical conditions.

The pity of all this is that things *would* grow in large towns if only the air could be purified. Houses conduce to warmth and shelter, and by

their contrast to vegetation add greatly to its charm. Many country towns have famous private gardens, Salisbury, for example; whereas the little gardens of the better class London house are generally eyesores of limp grass, smutty paths, and enfeebled privets and aucubas. It is to be hoped that electricity and an enlightened public conscience may remedy this by abating the smoke-nuisance.

[This Discussion applies to the subject before the Conference on Thursday morning—"Factory and Trade Smoke Abatement."]

MR. W. D. SCOTT-MONCRIEFF (London) said that he had been in two minds about joining in the discussions of the Conference because his own ideas were considerably in advance of those which were generally accepted. It appeared, however, from the address which had just been given by Sir Wm. Preece, that in Germany they were moving somewhat on the lines which he (the speaker) had advocated just twenty-five years ago in a paper read before the Society of Arts entitled, "Smokeless London." It was about the time when the Smoke Abatement Society was founded, and the proposal that was then in favour was one made by the late Sir Wm. Siemens advocating the use of coke in domestic fireplaces, supplemented by gas. We now have the interesting experience of Sir Charles Cookson, in the paper brought before the Conference on the previous day, from which it appears that he has carried out the suggestion made by Sir Wm. Siemens twenty-five years ago, giving details of how he has used coke and gas in his own house in London. The solutions of the smoke problem now proposed as being most feasible embody the position all along maintained by the speaker, that there must be a separation of the gas from bituminous coal before using it in domestic grates. He had always pointed out that a material which required exposure to the temperature of a red hot retort for six hours in order to deprive it of its gas was not likely to be treated so as to produce no smoke in a domestic grate, even under the skilled supervision of the most highly educated housemaid. He then went on to give a résumé of the following letter which appeared in "Nature" of December 16th, 1880:

> "I write for the purpose of expounding a scheme which, if adopted, would make London a smokeless city.
>
> When taking upon myself to explain a subject in a few minutes which has taken many years to develop in my own mind, there is a great temptation to put the reader in possession of the steps which led to the conclusion. The conclusion itself, however, has so much to recommend it that I will confine myself to the results of my reasoning only. It is enough to say that

they were arrived at, to a great extent, by an exhaustive exclusion of less feasible plans.

First then I propose to take advantage of the existing plant of the gas companies. I find they are amply sufficient for the purpose.

Instead of taking 10,000 cubic feet of gas per ton from the coal, I propose to take 3,333 cubic feet, and to pass three times the quantity through the retorts, or any other proportion that may be found most convenient. The result of doing so is startling.

The companies will have doubled the quantity of by-products they have at present in the shape of tar and ammoniacal liquids; the community will have 24-candle gas instead of 16-candle gas; the fuel resulting from the process will light readily, and it will make a cheerful fire that gives out 20 per cent. more heat than common coal; London would become a smokeless city.

In dealing with the figures I shall take them roughly, but in such a way that by including a few outlying corporations they could be made absolutely correct.

I take the total annual consumption of coal in London to be 6,000,000 tons. Of this I take 2,000,000 tons to be the annual consumption of the gas companies. The total quantity of fuel used for general purposes I take to be 4,000,000 tons of coal and 1,000,000 tons of coke sold by the gas companies.

We shall now see what would be the result if we treat the whole of the 6,000,000 tons in the retorts on an extraction of less than three hours, instead of the six hours at present prevailing.

The total quantity of 16-candle gas consumed in London may be taken at 20,000,000,000 cubic feet. This would be at the rate of 3,333 cubic feet per ton upon 6,000,000 tons, the total quantity of coal consumed in London. The residual smokeless fuel would amount to 5,100,000 tons. Of this 1,000,000 tons would be required for the extraction of the gas, leaving 4,100,000 available for the general uses of the community. This has to be compared with the 4,000,000 tons of coal and the 1,000,000 tons of coke already referred to as consumed at present. Now the smokeless fuel which results from an extraction of 3,333 cubic feet of gas per ton has a heating capacity fully 20 per cent greater than coke. This gives us the exact equivalents of the 5,000,000 tons of fuel at present in use.

So far the account as regards the fuel available for the community balances. We may now deal with the difference in value between 16 and 24-candle gas. As the value of the gas varies directly as its illuminating power, the calculation is very simple. If we take the average price of 16-candle gas to be 3s. 6d. per thousand cubic feet we shall find the total value of the 20,000,000,000 consumed in London to be £3,500,000, but as we have by my scheme the same quantity of 24-candle gas, the value will be increased to £5,250,000; here then we have an annual sum of £1,750,000 to place to the credit of the system.

Turning now to the by-products; seeing the gas companies by the new arrangements would subject three times the quantity of coal to the heat of their retorts during the period when the tar and ammoniacal liquors pass off most rapidly, I do not think I am wrong in estimating the yield at double its present amount. Taking this upon the tar and ammonia to yield 3s. 9d. per ton of coal, we find the total value of these by-products to be, at present, on the supposed consumption by the gas companies of 2,000,000 tons of

coal per annum, £375,000. This being doubled under my scheme, an additional sum of £375,000 must be placed to its credit.

But the basis upon which we have hitherto been arguing is that the gas companies under the proposed scheme are getting their coal for nothing. We have been supposing that the community become the purchasers of 6,000,000 tons of coal and hand it to the gas companies. At present London only pays for its general consumption on 4,000,000 tons of coal and 1,000,000 tons of coke. Let us now suppose that the companies pay the same sum annually that they do at present for their coals; if so, they would pay upon 2,000,000 tons, or an annual amount of £1,600,000 if their coals cost 16s. per ton. From this falls to be deducted the money they at present draw from their sales of coke, which, when taken at 6s. per ton of coal carbonised under the existing system, still leaves a sum of £1,000,000, which they could afford to pay per annum for the use of the 6,000,000 tons of fuel as proposed in my scheme. We will now take the total payments of the community for their coal to be upon 6,000,000 tons, for which we will further suppose they pay at the rate of 16s. per ton first cost. This would amount to £4,800,000 per annum. From this falls to be deducted the £1,000,000 contributed by the gas companies for the use of the fuel, also the £1,750,000 charged on the difference between the 16 and 24-candle gas already referred to, also the sum of £375,000 of additional income from the by-products. This would leave a net sum paid by the community for its fuel under my scheme of £1,675,000. Under the present system they have to pay, say 16s. per ton on 4,000,000 tons of coal, and say 12s. per ton on 1,000,000 tons of coke. This makes in all the sum of £3,800,000 per annum. Here then we have a balance in favour of my scheme of £2,125,000 annually. This may be taken as the yearly value of London smoke, which I propose to convert into useful products by *the plant at present in use.*

I have only in conclusion to say one or two words about the efficiency of the scheme as regards the fuel. It lights easily, it gives off no smoke, it makes a cheerful fire, it gives out more heat than either coal or coke, it will be cheaper per heat-unit than the coal at present in use, London would become a smokeless city, and all that would fall to be deducted from the sum of £2,125,000 per annum would be confined to a few items, such as the cost of additional capital required for transit appliances, and the terms to be made with the gas companies for carrying out the scheme."

All the figures given for the year 1880 apply pro rata to the present time. The speaker would have still been in doubt as to any practical result accruing from the re-introduction of his proposals, but that a reference in Sir Charles Cookson's paper to what is now being done in Germany seems to bring them into line with the most advanced practice of the present time. After remarking that nearly all the coke in the market is a by-product of gas retorts and its quantity insufficient to meet the demand in London, an observation that applied equally to the proposal of Sir William Siemens, he goes on to say that the only remedy is to produce "charred coal" which is the very material the speaker advocated in his paper, and further "this may be done and has been done in Germany and elsewhere." It is just possible that the changed conditions as to competition, in which the gas companies now find themselves, may lead them to

inquire as to how far their existing plant, with some alterations, is capable of adding to their dividends, and at the same time making London smokeless.

Judge Gibson (Edinburgh) said that experience in the prevention of smoke in Edinburgh had proved that where boilers had not too much to do in the way of raising steam, and with ordinary suitable fuel, it was generally possible to reduce smoke nuisance to a minimum by careful firing. Consequently, arrangements were frequently made with owners of furnaces to allow the inspectors in charge to supervise the stoking for a few hours, allowing the offender to watch the result, and if, as was usually the case, the emissions of smoke were reduced to a minimum, he was effectually silenced. This evidence was useful in the case of a prosecution which would follow a further offence. Of course, the adoption of mechanical appliances, such as automatic stokers, steam jets, and the distribution of air over and behind the furnaces, also contributed in a large measure to the abatement of smoke nuisance, and it was the common experience that where owners were convinced of the utility of these appliances, they were not backward in adopting them. For the improvement of the defective draught and to assist combustion, these, without doubt, were all more or less useful, but the burgh engineer was convinced that the methods adopted by their inspectors were the correct ones for checking the careless working of steam-boiler or other furnaces. The stoker or fireman was, after all, the man with whom rested, to the largest extent, the modification or otherwise of smoke nuisance, and by whom the merits of the very best patent appliance could be nullified. He it was with whom the inspectors endeavoured to come into direct contact. The effect of their periodic visits to the different works throughout the city, was that these men were kept constantly on the *qui vive*, and, as a class, they were usually found to be anxious to do their best. Indeed, in a great number of places, it was as much as their place was worth to persist in giving cause for complaint. About seven years ago the Burgh of Portobello was amalgamated with Edinburgh, and in this district there was a large number of works and manufactories all clustered together. As little or no supervision was exercised previous to the amalgamation, these were great offenders for a time, but the improvement was now most marked. Whatever might be the benefit of all these different kinds of smoke-preventing appliances on the market, and in actual use, it was the experience of Edinburgh that with careful and intelligent firing, and with the flues periodically cleaned out, there need be no excessive emissions of black smoke. It was, however, difficult to find experienced men who had a knowledge of their work. The duties were arduous and not very highly paid, and very often a man was engaged whose sole idea was to fill the furnace up with coal. These men were the real cause of smoke nuisance, and it was to them that strict attention was given. One of the queries in the list sent by the secretary of the Conference was to the effect, whether the existing powers possessed by the local authority for the prevention of smoke nuisance might be amplified in any

particular. It might be suggested that when one local authority was not satisfied with what an adjoining authority was doing in the matter, and especially if it could be proved that the first party was suffering thereby, then independent steps might be taken against the offender. To the south of Edinburgh there were several large breweries and other works, and the city got the benefit of their black smoke when the wind was in the right direction. It would be very beneficial could the city authority interfere, as there were several glaring offenders among them, and the burgh engineer understood that such powers did exist elsewhere.

MR. W. H. PATCHELL (Charing Cross, West End & City Electric Supply Co.) said that he was compelled to differ with the statement made by Commander Caborne on page 39 of his paper, that "suction draught, hot air and short chimneys might be a solution of this trouble," as after considerable experience with this system he was obliged to abandon the hot air plant as a most disheartening failure, and when the works in which the plant was erected were enlarged, the medical officer of health for the district requested that the second chimney, which was necessitated by the increased works, should be carried up higher than the first chimney which was used in connection with the fan plant, and for this reason the second chimney was built 120 feet instead of 100 feet in height. Suction draught had been used throughout the company's Lambeth works ever since, and it was possibly one of the largest installations of the system in England. The system, however, required very careful handling, as the nuisance from grit lifted by a strong draught, might readily be greater than the smoke which it was desired to avoid. He had tried a large number of mechanical stokers of various types, but had not yet found a thoroughly satisfactory one. Where the plant had to handle a suddenly varying load, the variations being caused by atmospheric changes, and out of the control of the works manager, no mechanical stoker that he had yet tested was able to compete with a thoroughly competent human stoker. It was stated that mechanical stokers would diminish the number of men employed in a boiler-room; they resulted, however, frequently in the necessity of a staff of mechanics to carry out repairs, which consumed the saving in stokers' wages. Further, many classes of coal had a very awkward habit of hanging on a stoker, which necessitated the introduction of a poker, this caused the emission of large volumes of smoke, in fact some of the stokers that he had tried, when under the control of the maker's own picked men, might almost be said to have made more smoke than steam. They had been told that morning that Berlin was beautiful in its absence of smoke. He had frequently seen dense volumes of smoke from factory chimneys in Berlin, quite as black as any smoke that he had ever seen in London. Generally speaking, however, there was much less smoke in Berlin than in London, because private houses used enclosed stoves and not open grates. Many people had not yet realised

that the bulk of what is called the smoke nuisance was caused not by factories but by ordinary chimneys which were not at present under control.

Mr. Julius Geldard (Bradford) said that Commander Caborne had shown them how inefficient the majority of the firemen employed were, and how necessary it was that they should be more fully instructed in the intricacies of boiler firing, with which he was most thoroughly in accord. Machine stoking, however, presented a solution of the difficulty in that it automatically reduced the number of points in which an imperfectly trained fireman went wrong, and it was certain that the best machine stokers, when used with common sense, were smoke preventers *with any kind of fuel.* It was essential that factories in London should be independent of any specific coal-field, in case of strikes, and every furnace must be constructed so that it could be adapted to suit different coals, as well as varying loads. There were machine stokers in general use which would do this far more efficiently than the best trained fireman could do; one association in the north having fitted as many as 200 boilers during the last two years. Hundreds of London firms were using machine fired boilers and smoky north country coal, whose names never appeared before the smoke authorities, because their chimneys were clean. He thought the author of the paper did not realise the enormous output of the machine stoking trade; one firm alone turned machines out at the rate of 15 to 20 a week, and others on a similar scale. It must not be forgotten that manual stoking was a dirty, hot and uncomfortable occupation, and the better class of man would not usually undertake such work; but with the modern high class machine stoker, conveyor and elevator fed, the obnoxious physical elements were removed and intelligent men could be obtained. With reference to the 15 or 18 per cent. CO_2 that the author recommended should be found in the waste gases, the figures were not possible by hand-stoking using bituminous coal, without making smoke, and carbonic oxide would be found in considerable quantities, thus causing a loss. With reference to the wear and tear of mechanical stokers he would say that one of the largest northern lighting stations with over 12 years' experience of machine-stoking, stated that the repairs averaged less than £1 per boiler per annum, and they burned over 40 lbs. per sq. ft. of grate surface per hour on load without smoke. Machine stokers could burn both dry Welsh and anthracite when fitted with hot air feed, but as anthracite cost in London from 18s. to 21s. 6d. per ton and a good steam small was being used by many firms at 10s. 6d. to 12s., it did not appear that at present anthracite could compete.

Mr. R. S. Richards (London) said that no one could have read the able article by Commander Caborne without perceiving the absolute necessity for trained and educated stokers. The very large installations would no doubt extensively adopt mechanical contrivances, but there were thousands of smaller

steam users who would continue hand-firing, and in London it was not generally known, but it was a fact, that smokeless coals could be obtained as cheaply as the bituminous coals. Welsh dry coals and anthracite coals could be delivered in the river from 10s. 6d. to 15s. per ton, and considering that they had a higher evaporation than north country coals he believed they were really cheaper. In view of cheap electricity he looked forward to the time when our cooking and house-warming would be done by this agent. No one, if they could help it, would have gas in their houses; but until they got electricity, he should advise gas for cooking and stoves burning anthracite. For heating, economy and cleanliness, nothing could equal anthracite. The intelligent and economical French and Germans had discovered this, and when it was realized that this fuel exists in millions of tons almost at our doors, he was astonished that we in London refuse to use it, preferring the dirty, wasteful, costly open fire-place.

DR. ORMANDY (Warrington) stated that in an early paragraph in Commr. Caborne's paper the statement occurred "what I particularly desire to lay stress upon is the paramount value of the personal equation." The point which he (the speaker) desired to lay stress upon was the paramount importance of reducing the personal equation to the smallest possible element. The object of all manufacturers at the present time was to reduce dependence upon skilled manual labour by the introduction, so far as was possible, of mechanical means to attain the same ends. It was for this reason that every encouragement should be given to those who were working upon the designing of improved mechanical stokers. At the best the human agent could only approximate to the ideal condition of stoking, namely, the introduction of the smallest possible amount of fuel with the greatest possible frequency. This could be attained in a far superior way by mechanical means. Mr. Kershaw referred to the Hamburg Smoke Abatement Society. The speaker could speak from personal observation as to the valuable work which was being done by this Society, but the conditions in the two countries were not exactly parallel, for the German worker was more accustomed to discipline, and more open to instruction. Years ago their technical managing director, Dr. Markel, had insisted that the combustion of coal was a chemical operation, and as such should be in the charge of trained chemists. Of course it was only by the harmonious working of the engineering and chemical staff that best results could be attained, but after the plant was erected, there was no question that the chemist was the man who should have control. In answer to the Chairman's question, he was able to confirm the statement that Messrs. Crosfields were saved over a thousand tons of coal per week, and this meant a great deal more than appeared in that figure, since it implied that they were saved the necessity for using almost double the number of boilers, with all their expenses of depreciation, firing, up-keep, etc., and the saving was at least equal to £25,000 per annum. As this fact seemed to have

evoked considerable interest, he was pleased to be in a position to say that the directors of the company had decided to throw their works open to visits from those who were particularly interested in questions relating to fuel and water economy. It had been urged that small works could not afford to employ a chemist whose knowledge and training were of the required calibre. This was perhaps true, but surely it would be possible to arrange some central authority who would be able to interpret results obtained by youths sent out to these various small works, youths who would be quite competent to carry out the necessary examinations of the samples. The results so obtained would be interpreted by the central authority and the works run in accordance with such interpretation. To show how little, comparatively, the expense need be, the speaker stated that it would be quite possible for two youths to carry out all the daily tests required in connection with their own large installation of 23 boilers and numerous furnaces. He ventured to think that some society on the lines of the Manchester Steam Users' Association, run for the mutual benefit of the subscribers, might easily be arranged to carry out the programme mentioned very shortly above. His own firm had been so frequently approached about this matter that they were (for a number of works in the vicinity) taking upon their shoulders the work ascribed above as being the function of a society founded on the line of the M. S. U. A.

MR. W. H. ATKIN BERRY (London) as a member of the Coal Smoke Abatement Society, replied to some of the observations which had been made by various speakers in reference to that society. It had been suggested by some that it should desist from prosecuting, and should in substitution instruct and advise offenders as to the best methods of preventing smoke. Such suggestions appeared to him to indicate an entire misapprehension alike as to the first duties of the society and its means. Its first duty was to enforce the existing law, which requires that black smoke *shall not be emitted*. It was established that such emission is preventable, and it was the duty of the society to see that the rights of the public are respected in this matter; it was not necessarily a condition that it should assist manufacturers in doing that which the law required of them. The law insists that burglars shall not break in and steal, but no reasonable person would suggest that the police force should desist from pursuing the offending burglars and resolve itself into a philanthropic society for teaching burglars how not to steal. The Coal Smoke Abatement Society would gladly *add* to its other duties the more pacific course suggested, but the necessary funds for that purpose must be forthcoming. The society depends upon voluntary contributions, and the public, while looking to it for protection, appeared to overlook this fact. Its efforts and the scope of its operations were seriously restricted by need of funds, and while welcoming suggestions it asked also for the financial support essential to give effect to them, and for securing that which was the right of all, viz., immunity from the nuisance of smoke, and

from the pollution of the atmosphere. The suggestion which had been made, that the society should recommend particular methods and systems of abating smoke was one which could hardly be entertained; it would place it in a false position; the Conference, however, might feel assured that the society is ready to assist in every possible way in securing the object of its existence, viz., the abatement of smoke. As to the suggestion, made by Sir William Preece in his address, that the society should "record the firms who had adopted scientific measures and shown their economical results," Mr. Berry pointed out that it had already adopted that course, and the paper read that day by Dr. Rideal had specifically detailed the results. They were still pursuing those investigations, and would gratefully receive, examine, and record all information upon the subject which might be furnished.

MR. J. MACAULAY (Liverpool) said that it would be well if the word "black," in relation to smoke, were omitted from any future Public Health Act. Smoke, whatever the colour, consisted of vapours produced by the partial combustion or distillation of coal, or in other words, of valuable hydro-carbons and sulphur compounds, the visible portion; and the equally valuable invisible portion, the poisonous gas, carbonic oxide, the ranges of colour being due to the quantity of sulphur compounds present. Now, although carbonic-oxide might be emitted from a smokeless chimney, the presence of smoke was a sure indication of the presence of the gas; and the effort intelligently made to stop the emission of smoke would mean the preventing of the emission of carbonic-oxide. When a manufacturer was convinced of the fact that burning his coal to produce only CO meant the production of 4,450 British thermal units, whilst burning it to CO_2 meant the production of 14,540 units, he would co-operate with them in preventing smoke. He could find out by using an automatic CO_2 recorder whether his coal was being burnt properly or not, and if a fireman knew that his name would be placed on the record taken during his term of duty, he would be induced to do his best. Mechanical stokers, of the coking type, were efficient if kept in order and used for steady loads. But where the load was varying good hand-firing was best. In Liverpool the smoke inspectors, who were trained engineers with Board of Trade certificates, visited the works and advised manufacturers to direct their men (where hand-firng was carried on) to fire regularly, to throw on small quantities at a time, and frequently.

MR. E. P. GROVE (Central London Railway) said that, as the engineer of one of the large power stations, he thought the London Smoke Abatement Society went rather too far at times, and that their action was approaching persecution. His company was doing all in its power to obtain smokeless economical combustion of the fuel. They had replaced their mechanical stokers by hand-firing, burning Welsh small coal, and finding that caused trouble with

the coal dust and was still liable to smoke, they washed their coal, and now when experiments were being made to obtain smokeless combustion with other classes of coal and mechanical stokers, if they had the misfortune to make smoke, they were reported and threatened with proceedings. An automatic CO_2 recorder was used, and regular boiler testing and training of firemen was adopted, the stokers being paid a bonus on the results obtained. Large sums were now paid monthly to the stokers in this way, over and above regular wages. An all round efficiency of 74 per cent. was obtained in the boiler house. They had been carrying out a large number of experiments in stoking methods, and had tried many alterations to a mechanical stoker with a view to finding a satisfactory solution of the smoke problem, and were prepared to go still further, but this work could not continue if the Coal Smoke Abatement Society adopted a persecuting spirit, and these experiments would have to cease if the officers of that society decided to report and fine them for every slight emission of black smoke. He should like also to say that allowance should be made to those who have to carry out their work by the burning of large quantities of coal, and that the amount of smoke emitted should be considered in proportion to that quantity, and particularly that those who the society knew were endeavouring to find better means of abating the smoke, should be treated differently to those who make little or no effort. He thought that only on lines such as this would the question be definitely decided, and the best means, having in view commercial success, be brought to light, as after all he did not suppose that the Smoke Abatement Society really wished to stifle commercial enterprise. He could not agree with those that argue that smoke abatement must *necessarily* follow economy.

DISCUSSION ON

IS THE INTERCEPTING TRAP A FAILURE?

Opened by WILLIAM BUTLER, M.B., D.P.H.,
Medical Officer of Health, Willesden.
(FELLOW.)

And R. READ, A.M.I.C.E.,
City Surveyor, Gloucester.
(MEMBER.)

At Sessional Meeting, London, February 14th, 1906.

W. BUTLER, M.B., D.P.H.

BEFORE answering such a question as this, it will be necessary to consider the purpose of the interceptor in a modern system of drainage. And it may be desirable to go to the root of the matter and consider first the primary hygienic and physical principles which underlie modern methods of sanitation as applied to the removal of human excreta and slop waters by a water-borne system. It may be said that they simply aim at the removal, as rapidly and efficiently as possible, of all foul or waste decomposable organic matter from the neighbourhood of human dwellings; and that equally important with the rapid removal of sewage matter is the prevention of any accumulation and escape of the gases of decomposition or of polluted waters near to the house. Whatever view be taken as to the *modus operandi* by which these agencies produce disease, it will be conceded that the admission to the house of such gases, or the pollution of the site by liquid filth, is wont to be followed by outbreaks of disease often explosive in character, and is in any case calculated to impair health. The aim of modern drainage is simply to secure the dwelling from these untoward results, and upon the degree of success which in practice attends this aim must the means currently adopted be judged.

I shall endeavour to show that a drainage scheme in which the drain is disconnected from the sewer is as mischievous in practice as it is faulty

in theory. It is based on the assumption that it is safe to have a condition of things in the public sewers that it is unsafe to have in the house drains which communicate with the sewers, and that you may recognise the existence of a danger zone on one side of a trap against which the other is assumed to be safely secured by a water seal.

It must of course be conceded that the inside of a sewer can never be regarded as a sanitary situation, but from this to the assumption that its gaseous contents may be contemplated as so potently charged with danger that they may not even be admitted to a gas-tight system of tubes having no unsealed opening save to the outer air above the housetops, is a most serious confession of sanitary failure. The truth is that accumulations of considerable volumes of sewer gas are dangerous and insanitary, whether they be permitted to stagnate in the sewers or in the house drains. If the sewers are efficiently ventilated, as they should be, there is no ground to suppose that the atmosphere of the sewer is more harmful than that of the house drain, and the disconnection of one from the other is not only harmful, but irrational also. For it presupposes what sanitarily cannot be presupposed, namely, a dangerous atmosphere in the sewers; and it is an attempted defence, by means of a trap, against this danger, which in its very adoption casts doubt upon the efficiency of the means, since the same are used in the defence of the house against the still dangerously regarded atmosphere of the house drain. But it may well be urged that academic objections to the intercepting siphon are little likely to disturb so trusted and respectable a contrivance of the practical sanitarian. I will only answer such an objection by saying that the siphon had its origin less in a practical need than in a faulty theory, and that academic criticism alone should have prevented the extensive adoption of what many regard as a mischievous appliance.

Perhaps the most universally objectionable feature of the siphon is that it prevents the efficient ventilation of the sewers. That the public sewers are inefficiently ventilated in those cases where their communication with the soil-pipe ventilators of the house drains is intercepted, is shown in many ways. It is a common experience with municipal officers that daily complaints are received, during the summer months, of the offensive smells proceeding from the openings to the sewers in the crown of the roadway, placed there originally with the intention of acting as fresh-air inlets to the sewers, and now in many districts being sealed off because they are found to act as vents for the foul gases of an insufficiently ventilated sewer. Visual demonstration of this fact may be had during

frosty weather, when a stream of condensed vapour may be observed proceeding from these openings into the sewers. It might also be shown with regard to most sewers that the number of upcast shafts which it has been possible to erect are insufficient to cause such a negative pressure in the sewers as shall result in anything like continuous aspiration of air into the sewers through the road openings.

But, short of effecting this, the road grids become a nuisance owing to escape from them of the gaseous contents of the sewer at the street level, and under conditions, owing to inadequate sewer ventilation, in which these gaseous contents are apt to contain a large admixture of sewer gas, I think it will not be disputed that what is most urgently needed in respect of most public sewers, is an increased number of exit ventilators intentionally so acting. And could these be provided in sufficient numbers—as practically at present they cannot be—the problem of sewer ventilation would be solved, and the atmosphere of the sewers would then be rendered as innocuous as rapid change in the aërial contents of the sewers can render it.

Such sufficient numbers of upcast ventilating shafts would be provided were each house drain and soil ventilating pipe in direct aërial communication with the sewers. The aspirating effect of so many outlet ventilators to the sewer, up which the lighter air of the sewer would tend constantly to ascend would be a rapidly inflowing current of fresh air to the sewers at all lower openings; and thus at one and the same time both the sewers and the house drains would be effectively ventilated and any accumulation of gases of decomposition, either in the sewers or the drains or their escape in improper situations, rendered impossible.

The interception of the drains from the sewers, however, has deprived the sewers of what should be their natural outlet and on occasion inlet ventilators. It has necessitated the provision on each house drain of an untrapped opening, in a large proportion of cases in immediate proximity to the doors or windows of the house, and acting, at least with a frequency uncontemplated in the theory of its advocates, as an outlet ventilator to the drain. Further, to provide access to the segment of the drain between the interceptor and the sewer, another complication in the shape of a raking arm with a readily removable stopper has to be added. An inspection chamber is a proper equipment of every drain, but the interceptor, necessarily placed as near the sewer as practicable, has necessitated the placing of the manhole where the drain is deepest, and where, apart from the consequently increased cost, it necessarily forms a capacious reservoir

for the storage of gases at the very site where they are most likely to accumulate owing to the couple of gallons or so of stagnating sewage contained in the trap at the bottom.

Every one of these complications introduced into drainage systems to meet the exigencies of the interceptor is extremely apt to go wrong and produce nuisance. The interceptor itself is essentially insanitary. It retains within the precincts of the house premises between two and three gallons of sewage which is of that aggravated character resulting from the undue retention of solids, and thus breaks with the primal principles of domestic sewage disposal. It occasionally fails of its object of excluding from the house drains the gaseous contents of the sewers; for it was urged in defence of the system by the late Dr. G. Buchanan, in his Report to the Privy Council and Local Government Board, that should "the trap be ever forced by pressure of air in the public sewer, an immediate exit of the sewer air away from the house is afforded"—by the so-called inlet ventilator to the drains. The plating down of the street gratings to prevent the offensive smells from the sewers, which the introduction of the interceptors has occasioned, will, especially where shafts have not been erected in their place, make this forcing of the trap a more frequent occurrence than was contemplated. Where no facilities even for inadequate ventilation of the sewers are provided, the daily recurring increases of pressure of the imprisoned gases must necessarily force them through the yielding traps into the house drains.

And this contingency, to which every house drain disconnected from the sewer by a trap is subject, is a greater danger than is incurred when sewers and house drains are the channels for the constant flow of continuously renewed currents of air. This is a breakdown of the interceptor, the frequency of which it is impossible to estimate. But it fails in other directions. A straight pipe with a proper fall shows little tendency to choke, but if in the course of such a pipe an acute kink or bend be introduced, especially if it be of such a character as to remain filled with floating solids, the tendency to become choked at this point will have increased enormously. During last year, I had a systematic inspection made of all the readily accessible manholes in my district. These amounted to some 6,745, and comprised the inspection chambers of about a third of the houses in Willesden. In no single instance was a drain found to be choked but at the interceptor, but no fewer than 288 or 4¼ per cent. of all the drains inspected were discovered to be stopped at this point.

In 118 of these cases the manholes were filled with fœtid sewage, emitting its foul vapours through the drain inlet ventilator close to the doors and windows of the houses, into which they were duly aspirated.

In the 170 remaining cases where the drain was blocked, the manhole remained free of sewage, because of another accident of the system, the unstopping of the raking arm, which permitted the escape of the drain contents to the sewer, and incidentally of the sewer gas through the manhole and drain inlet ventilator.

In 654 cases this accident was observed to have occurred. That is to say in nearly 10 per cent. of the drains examined the interceptor, apart from its incidental drawbacks, failed absolutely of its object, the drains in these cases being in direct communication with the sewers, the sewers being thus provided with exit ventilators in the forecourts of the houses. But for the drains to be accidentally in direct communication with the sewers in only 10 per cent. of the houses is much more serious than for 100 per cent. of the drains to be intentionally directly connected with the sewers. In the one case the sewer is adequately ventilated, in the other the sewer air is presumably 10 times more concentrated than where all the house drains ventilate the sewer. In the one case, moreover, the sewer air, diluted and comparatively innocuous, finds vent above the roofs, and away from all openings to the houses; in the other, a concentrated sewer air is laid on at the ground level of the houses. The untrapped opening to the drain, intended as an inlet ventilator, becomes in these cases a serious danger to health. But to such an extent is the inlet ventilator recognised as a common cause of nuisance, owing to its waywardness of acting as a vent for foul gases, that it has become common practice to fit it with a mica flap to prevent reflux currents from the drain. In 3,193 cases of those I investigated, however, the fresh air inlet was unprotected by any properly acting appliance. This may appear a trivial matter, since at its inception no valve was considered necessary. But it must be remembered that admission to the house of air from the interior of the drain is still, and I think properly, regarded as dangerous. Most people who would remain unmoved at the forcing of the intercepting siphon would feel alarm at the unsealing of the yard gully, and a crack in a drain pipe covered with two or three feet of clay is regarded as a most serious insanitary condition by people who are undisturbed at an unprotected gaping opening to their drains a couple of feet below their open window.

It might be thought that the result of the inspection of nearly 7,000

manholes yielded exceptional results due to accumulation of stoppages long unrecognised. It is true that in many of the stoppages there was evidence of antiquity in the insanitary condition discovered, but in many parts of the district there had been previous systematic inspections yielding results quite as bad, though in less numbers, owing to the more limited area of investigation. Nuisances of the character discovered are, moreover, constantly being abated, being the natural occasion of prompt complaint. I have, however, had a re-inspection made of about 500 manholes with a view to seeing whether the results yielded by the first inspection were confirmed. The re-inspection was made within eight months of the first survey, and included 216 manholes where originally no defects were discovered, and 288 where defects originally found had been made good. Out of the total of 504 re-inspections, 49 drains were found to be choked at the interceptor, and 41 to have the cap of the raking arm missing. Of those choked, in 30 instances the manholes were more or less filled with sewage, while in 19, in addition to the choking of the drain, the manhole was in direct aërial communication with the sewer, owing to the absence of the cap of the raking arm. Altogether in 71 instances the drain was choked, the cap of the raking arm missing, or both these conditions co-existed. Thus in nearly 15 per cent. of the manholes re-examined, the most serious defects were discovered. Both in these and in those primarily discovered the defects are traceable to the interceptor, and the modifications which it entails. In an examination of over 7,000 manholes it is found that in 9·5 per cent. the interceptor fails of its object of disconnecting the drain from aërial continuity with the sewer. It fails not only of this, but is directly responsible for a high percentage of blocked drains, and manholes converted into leaking cesspools.

The untrapped drain-opening in the forecourt which it necessitates, normally serves as an outlet for the emanations of the drain, and sets at ridicule all insistence on the need for effectual trapping of yard gullies and the elaborate precautions taken to secure a gas-tight drain.

In the very frequent abnormal conditions where the drain is choked, and the raking arm open to the sewer, it is an unmitigated nuisance. It is for these reasons that I am bound to answer the question we are discussing in the affirmative. It is perhaps beyond the range of this discussion to say what is the counter proposal; but, in conclusion, I may give what I consider the essential principles of sanitary drainage. A good drain should be so laid as to be self-cleansing; so as to be relied upon to remain gas-tight and water-tight throughout its course. It should have no untrapped

opening save at the top of the soil pipe above the roof. Both the drain and the sewer should be effectually ventilated. Access should be provided, but the drain should be hermetically sealed from the access chamber except when occasion arises for inspection.

These conditions will probably best be complied with by the provision of iron pipes with socketed joints, caulked with blue lead. The inspection chamber can be placed in the shallower part of the drain, in the absence of an interceptor determining its position in the forecourt, and the saving in cost thus effected will generally be more than sufficient to cover the additional expense of using iron pipes throughout the whole of the drain.

Drainage would thus be simplified and cheapened; theoretically it would be consistent in detail, and practically it would be efficient, little likely to get out of order or to require amendment. The provincial view that you could have a satisfactory drainage system for your house, while the public sewers at your doors must be regarded with suspicion, would give place to the more concrete view which alone is defensible, namely, that the drainage problem is *one* hygienically, whatever be the need for legal or administrative distinctions between public sewers and private drains.

R. READ, A.M.I.C.E.

IN the author's opinion the answer to the above question is yes. The intercepting trap is intimately connected with the larger question of the ventilation of sewers and drains, which has been the subject of controversy, more or less for the last 30 years, commencing after the illness of the King when Prince of Wales in 1872. In this controversy the author has taken a somewhat active part at various times.

The intercepting trap was patented by Mr. W. P. Buchan, of Glasgow, about 1875, and without any special investigation was adopted by the Local Government Board, and introduced into their model by-laws in 1877. Ever since then this official recognition has caused it to be taken for granted by large numbers of people, and has deterred many from investigating the question for themselves.

The controversy above referred to resulted in a general concensus of opinion that "sewer gas must be cut off from the house," and the intercepting trap was adopted by the Local Government Board with this

object, but this was trying to cure one evil by introducing another.

In its original form a 6-inch intercepting trap contained over three gallons of stagnant sewage; it took the place of and was the same length as an ordinary drain pipe, with from 2 to 3 inches difference of level between the inlet and outlet; its form has since been modified by various makers, in the vain attempt to perfect it, chiefly by contracting the body to increase the scour, and the contents are now about 2½ gallons or 25 lbs. weight of decomposing sewage, or about an ordinary bucket full. The trap uses up the fall required by four or six ordinary pipes, it is inserted at the lower end of the underground portion of the house drain, forming an obstruction therein nearly 8 inches deep to the flow of the sewage, it causes the sewage to deposit from 25 per cent. to 35 per cent. of its solid matter in the trap after each discharge in dry weather, and paralyses the flow of the sewage through the whole length of the underground portion of the house drain. During dry weather the contents of the trap are always more or less putrid, and contaminate both the drain and the sewer to which it is connected.

The intercepting trap necessitates in the front of the house, near the front door or windows, the so-called fresh air inlet, which acts alternately as an outlet and an inlet with every discharge from the drain. A mica or aluminium flap valve is generally fixed to these inlets in order to prevent them acting as outlets, but the constant flapping action accompanying every discharge from the drain, very soon damages the flap to such an extent, that it becomes useless, and the result is that in most cases the householders promptly stop up the opening, to get rid of the nuisance. When the houses are built close to the public footpath, the trap has to be fixed below the ground floor or basement of the house, unless the Sanitary Authority allow it to be fixed outside below the public footway.

The trap is liable to frequent stoppage, and is provided with an inspection chamber, or man-hole, to facilitate its clearance; but these inspection chambers are, as a rule, only opened when a serious stoppage occurs, which causes the sewage to show above ground.

The great majority of stoppages in modern drains occur at the intercepting trap, and many are unknown to the householder, because they clear themselves by the accumulation of sewage in the inspection chamber and drain, until a sufficient head of sewage is produced to force the obstruction through the trap; the result of these temporary stoppages being that the brickwork of the inspection chamber, of about four to six square yards area, and a considerable length of the drain, become

plastered with a slimy deposit of decomposing sewage. When the pressure of the head of sewage is not sufficient to force the obstruction, of course the sewage shows at the yard gulleys, and men have then to be sent for to open and clear the drain.

The trap is introduced into the lower end of the house drain, on the erroneous assumption that it is a safeguard to the house, but it is no protection at all; on the contrary, it is a useless and dangerous obstruction, which provides at every man's front door the very conditions and dangers which it is the object of modern sanitation to prevent.

These traps now form part of many thousands of existing drains, and while they absolutely prevent the adoption of a proper system of ventilation, they also provide a reservoir of putrid sewage on every house drain to contaminate everything passing through it, and thus cause noxious gases and smells to be generated in the drains and sewers, which cannot be got rid of by any amount of flushing of the sewers alone, and the more numerous the traps the greater the nuisance. The trap necessitates the use of at least 50 per cent. more water in the flushing cisterns to the w.c.'s, and even a three-gallon flush is not sufficient to prevent stoppages. A series of experiments were carried out by a committee of this Institute in 1893, which proved that even with a three-gallon flush, through a properly constructed straight drain 50 ft. long, 6 ins. diameter, laid with a fall of 1 in 40, on trestles above ground, as the result of 600 discharges, 27 per cent. of the solids were left in the intercepting trap after each discharge, and with a two-gallon flush 35 per cent., and the committee recommended three gallons as a minimum. More recently the experiments of Dr. Porter on an actual 6-inch drain in connection with a factory, proved that the intercepting trap could only be entirely cleared out by a six-gallon flush.

The great object of a system of drains and sewers is to discharge the sewage at the outfall in the shortest possible time. Why, therefore, should we put an obstruction into every drain to defeat this object?

The intercepting trap is wrong in principle, and is no remedy for either a badly constructed drain, or sewer; it cannot protect the house from the action of a defective drain, and it is liable to be forced at any moment: the true safeguard to the house and its inhabitants being a sound drain laid with a good fall, gas-tight joints, and properly ventilated by a full size pipe to above the roof of the house. On such a drain the intercepting trap is a useless and dangerous obstruction, but its absence allows the drain to be laid with a better fall, to remove the sewage quickly while in a fresh state, and to keep itself clean; this in turn acts

upon the sewers in a similar way, enabling the sewage to be discharged at the outfall before decomposition can take place. No sewer gas would then be generated, but only the watery vapour which rises from every wet surface, especially in dry weather, and this could then be easily dealt with by the ventilation of the sewers through the ventilated house drains. Neither the drains nor the sewers would be under any pressure, the traps at the waterclosets and gullies would be amply sufficient to protect the houses, and a general improvement in the health of the community would follow, because the fresh vapour of the sewage would be promptly oxidised, in its initial stages, before it had time to become putrid or dangerous; the only object of sewer and drain ventilation, beyond relieving pressure, should be to deal with this fresh vapour, and it should not be asked to do so after this has been allowed to develop into sewer gas.

MR. H. ALFRED ROECHLING (Westminster), as one who had had a great deal of experience in the sewerage of towns, the ventilation of sewers, and the drainage of houses, observed that in considering this question two main principles must not be lost sight of: that prevention was better than cure, and that of the two evils—escape of sewer gas or sewer air in our houses, *i.e.*, in confined positions, and escape of sewer air in the streets, *i.e.*, in not confined positions—the latter was the less. Everybody was agreed on this. In the following remarks he would always assume, both in the case of public sewers and private drains, that they were properly designed, properly constructed, and properly maintained, as it was absolutely useless to argue the points on any other premises. Those who wished to convince them that the disconnecting trap was obsolete and had far better be abandoned, must in order to carry their case prove either the one or the other of the following contentions. They must either show that sewer gas was beneficial to health, or if that were incapable of proof, they must clearly demonstrate that the air in the public sewers must always be at least as good as the air in house drains, and further, that the disconnecting trap must in every case prove an unmitigated nuisance. If it could be shown that sewer gas was beneficial to health—and here the negative proof could not be taken to establish positive evidence—the necessity for the disconnecting trap, and as a matter of fact of all other traps, disappeared. The difference between the disconnecting trap and the traps in the house was one of degree only, the difference consisting in the depth of

the seal and the quantity of waste water retained. As the authors (at any rate one of them) had frankly admitted that sewer gas was dangerous to health, it seemed perfectly logical that they should do all in their power to prevent its being laid on systematically to our houses. In the absence of proof of the beneficial character of sewer gas, the opponents of the disconnecting trap had, therefore, to demonstrate that the air in public sewers could never be worse than the air in the house drains, and that further, every disconnecting trap must prove a very serious nuisance. To establish the first contention it would not do to say that the air in the public sewers *might* be as good as in the house drains, as in that case it might also be considerably worse, and as it was generally the unexpected that happened, it was plainly our duty to guard against the pollution of the air in the house drains from the public sewers. He then went on to discuss the conditions in a public sewer that had been carefully constructed on the separate system, and was carefully maintained, and showed that owing to the intermittent flow, especially in the more level parts of a town, one could never make sure of the air in it being perfectly sweet and free from smell. If sewer air carried pathogenic germs such as those of typhoid fever and of other preventable diseases, and if it carried volatile ptomaines, these would be more or less present in the air of public sewers, especially in large towns. With a house drain, especially where baths were in use, the case was altogether different, and here it was not overstating the case to say that in a carefully constructed and rationally maintained drain the air would be perfectly sweet. This was known to all those who had frequently examined good house drainage systems. The contention that the air in public sewers must always be at least as good as the air in house drains could, therefore, not be established, and hence it seemed perfectly reasonable to establish a barrier between them. But if it could be shown that the particular form of barrier now universally adopted—the disconnecting trap—was wrong in principle and must always be an unmitigated nuisance, it was high time to abandon it in favour of another form. The disconnecting trap had now been in existence for about twenty-five years, and there must be at a moderate estimate millions of it in use. Was it imaginable that if it had proved a failure in every case they would still go on employing it? On the contrary it would have, and that deservedly, disappeared from the scene long ago. This contention was strongly supported by the Willesden experience, mentioned in the first paper. For if he read the paper aright it was shown there that out of every 100 cases the trap had proved perfectly efficient in 90, so that the chances were as 9 to 1 in favour of the trap. This was, however, well on the road to dead certainty that it would prove perfectly satisfactory, and if for this reason they were bound to condemn it they would have to condemn every apparatus now manufactured. For there was no such thing as an apparatus, that however improper its use would not get out of order. It was not his province to explain the failure in Willesden of every 10 traps out of 100, but he might say from his experience that where a carefully constructed disconnecting

trap had not fulfilled its expectation this was in nearly every case due to gross sanitary neglect on the part of someone. Granting, however, solely for the sake of argument, that a disconnecting trap was not a necessity, his experience told him that the arrangements of a cast iron drainage as suggested in the first paper, and especially as shown in the diagrams on the wall, would not give them reasonable security against the entrance of sewer air into their houses. Even if all the house drainage systems in this country could be so well superintended that all the joints both below and above ground were absolutely gastight and remained so for say 50 years, that all the ventilated ends of soil pipes were carried above the roof without bends so that an accumulation of rust and dirt in them did not block the passage of air through them after a few years, it was well known that the water seals of the traps in their houses were subject to being broken either by pressure or siphonage, and that sewer air would escape at the point of least resistance wherever that happened to be, either inside or outside the house. If, for instance, the air in a long length of soil pipe was too heavy for the sewer gas to force, the latter would break through the water seals of the traps inside the house. Or, if the case was taken of a house let out on the flat system and they assumed that one of them stood empty for some time, which was by no means an unusual thing, would not in such a case, after the water in the traps had evaporated, sewer gas enter and unknown to the other inhabitants roam through the whole building without check or hindrance? But apart from this, what would be the responsibility of the authorities if it could be shown that sewer gas from the public sewers had entered a particular house and there caused serious or fatal illness? A case of this kind had been tried in August, 1896, at the Birmingham Assizes, in which judgment for £2,875 had been given against an Urban District Council. This was not a discussion on the ventilation of sewers, hence he could not discuss the subject, but he might perhaps be permitted to say that it was well known now that there was no such thing as constancy in the direction of the air currents in sewers. The movement of air would at one time be up-hill and then change to a down-hill one, and the only thing that they could make sure of was continual change. This held good not only for public sewers but also for private house drains, and in districts without disconnecting traps it had been amply shown that the air current was not permanently in the direction from the public sewer to the house, but frequently changed into the opposite direction. In this connection he might mention the Bristol sewers, which were not ventilated at all, and where as had been observed there was a strong down-hill current. It could, therefore, not be correctly maintained that in the absence of disconnecting traps the public sewers would always be ventilated by the private house drains. Was it not further also correct to say that should, in cases, the disconnecting trap prevent the ventilation of the public sewer through the house drain, its use was more than amply justified by considerations for the health of the inhabitants. From the foregoing remarks it would be clear, he hoped, that the contentions necessary for

the abandonment of the disconnecting trap could not be successfully maintained, and the position so far taken up by owners and occupiers of houses, that they with the use of the disconnecting trap should see to the ventilation of the house drainage system, and that the authorities must provide for the ventilation of the street sewers without recourse to the house drains would, therefore, seem perfectly logical, hence reasonable and justifiable. Engineers were accustomed to provide in all their constructions a factor of safety, that is, they designed their structures so that they could withstand a strain of from four to six times greater than the calculated one, and this was for the express purpose of meeting unforeseen accidental conditions over which they had no control. Why should they abandon a factor of safety in sanitary works, where it was doubly necessary? The disconnecting trap properly constructed and rationally maintained provided such a factor of safety, which was convenient and cheap, and he hoped it would not be abandoned except under very special circumstances. Was not an Englishman's home his castle, and why should they allow its invasion by sewer gas any more than by anything else?

DR. CHARLES SANDERS (West Ham) said he came with the object of lending his support, from the experience of West Ham, to the views enunciated by Dr. Butler and Mr. Read, but after the remarks of the last speaker he felt he should apologize for representing the views of a large town with apparently very inferior drainage. For if it were true, as stated, that a drain properly laid with an interceptor, inlet and outlet ventilators only contained pure air and did not stink, then he found it impossible to explain the reason why the drains laid by his colleagues the Inspectors of Nuisances, whose training the Royal Institute vouched for and whose ability and care he himself could vouch for, did in numerous cases result in most obnoxious odours at the so-called fresh air inlet—a condition generally remedied by the occupier who blocked it up. He would ask someone to describe the difference between drain air and sewer air. Personally he did not recognise any difference, for under the Public Health Act, 1875, as soon as two houses were drained by a single pipe, the pipe became a sewer; yet the advocates of the interceptor did not feel it incumbent upon them to place one at the top end of such a sewer, but allowed several houses to drain into one pipe sewer, and placed the interceptor between the sewer in the road and the sewer on private property, thereby allowing the sewer air above the interceptor to escape freely into the house drain at the top end. Dr. Butler had shown what actually did happen when intercepting traps were used; the only argument adduced in opposition to the abolition of interceptors consisted of opinions as to what might or would happen if they were abolished; but no instances of injury to health or nuisance were found in connection with the thousands of drains which had no interceptor. He trusted the result of the discussion would be to frighten away the bogey of the assumed danger arising from the ventilation of sewers by means of the house drains.

Mr. C. Chambers Smith (Engineer and Surveyor to the Sutton Urban District Council) said he could not agree with the first two speakers, and after Mr. Roechling's remarks he thought it would be agreed that the bottom had so far been knocked out of their argument. The main objection to the intercepting trap was that it got blocked up. Well, there was no apparatus that did not. An intercepting trap was just as necessary as a gully trap, and which of them would say that because that got blocked up it should be abolished? As to the fresh-air inlet venting on to the windows of houses, that objection was met by carrying the pipe higher up the side of the building. Another point was that they had not yet proved the necessity of ventilating sewers. The danger of abolishing intercepting traps was one that they should not encounter. The risk attendant upon having sewer gas laid constantly on to houses, which would be the case if intercepting traps were abolished, was too serious to be lightly undertaken, and, as everyone knew, it was impossible to guarantee that a drain passed as sound would remain so for two years; therefore where, as for instance, drains ran under houses, the escape of sewer air could and would go on until it produced disease and possibly death. It was suggested that with free ventilation of sewers, the offensiveness and danger of sewer air would be practically abolished, but this could not be supported, and was not in accordance with facts. In the upper reaches of sewers, where the sewage was fresh, the odour was not so intolerable; but when sewage had travelled some distance in the sewer it became putrescent. No amount of ventilation could destroy its offensiveness, and one had only to remember as a case in point the condition of an absolutely open sewer, such as the River Aire at Leeds, to recognise that neither dilution nor oxidation could destroy such conditions. It therefore meant that houses adjacent to such sewers would be—as regards danger and offensiveness from sewer air being laid on to them—in an intolerable position. The objection to intercepting traps had been raised, he admitted, by municipal engineers in consequence of their inability to ventilate the sewers by themselves, and medical officers of health had hitherto, and rightly so, in his opinion, been adverse to their abolition. It was not, however, the duty of occupiers and owners to ventilate public sewers, and local authorities should find a proper remedy and not risk the menace to health which would be introduced if intercepting traps on house drains were abolished.

Mr. F. Wood (Fulham) said that, viewing the matter broadly, he thought the majority of those present would agree with what the authors of these articles had said. They had, however, to view this question from the "exception" point of view. Intercepting traps, if used properly and judiciously, were not a failure. When the trap was a failure, it was for the reason that its application was at fault. The w.c. was a trap, but no one would suggest that this should be dispensed with, and the pan left freely open to the main sewer. If the soil pipe from the w.c. had no anti-siphon pipe, then the interceptor at the foot of the

soil pipe was desirable and necessary—especially was this the case if there were series of w.c.'s one above the other; if one should be untrapped by the working of the w.c. on a higher floor, this trap would prevent the gases entering the house. The interceptor at the w.c. was properly worked and was satisfactory; every time it was used it was emptied of the previous contents. The only method of clearing an intercepting trap was to send down a large quantity of water in a short time—more than ever would go down from a single w.c. If the w.c. trap was with difficulty cleared by means of the quantity discharged from a two-gallon cistern, it must be impossible for this action to take place in regard to the larger intercepting trap placed at so great a distance as 30 feet away, with an approach of 1 in 30 instead of a vertical one. The water passed through a trap by displacement; if the velocity was small, one could easily imagine the water passing through, and the floating or solid matter being intercepted or held back by the obstructing trap. Any noxious gas generated by the matter in the trap would either remain in the house drain or escape by the so-called air inlets or air outlets. He could confirm the writers of the articles in their condemnation of the air inlets, which were placed immediately under windows and in positions where children might use them and tamper with the mica flap as if it were something placed there for their amusement. The trap intercepted the gases from the sewer; he believed it did this effectively. If this was the object, then it was not a failure. But if the trap was not in existence, the gas would still be intercepted from the house by the trap at the w.c. and gully. Then why place an interceptor in the sewer? The answer to this had been that there were people who did not use the gullies, w.c.'s, etc., and the water evaporated and the trap became an open ventilator, whereas the interceptor would always be full of water, and oftentimes clean water, from the rain-water that entered the drain, so that if the w.c.'s were not used, this trap was placed there in a position where it would always have water, and where there could be little or no evaporation. Many said that it was impossible to become infected with disease from sewer gas when it passed through the air, while others had agreed that there was danger, so the ordinary man in the street knew not what to do, and he took double precautions—as in this case he thought two interceptors were better than one.

MR. WILLIAM GREEN (Finsbury) said he advocated the abolition of the trap. If the intercepting trap were abolished ventilation could be improved by means of ventilating pipes or soil pipes being affixed to the drain of each house, whereby the gases generated in the sewers by decomposition would not only be carried away more quickly but would be distributed over a greater area. If sewer air was so bad they should protect themselves against it, and this could well be done by having a good drain, tested with water when constructed. He did not consider an intercepting trap was a necessary appliance, and if the drains were properly ventilated they would be much better without interceptors.

(1) Mr. Geo. M. Pettit (Kensington) said he should like to ask a few questions. Would Dr. Butler tell them:—If, in that part of the district where diphtheria was most prevalent, the houses were flooded by storm water from the sewers during heavy rains.

Dr. Butler replied that that portion of the district referred to was one that was least flooded by storm water during heavy rains.

(2) In how many cases were the traps that were found to be choked, level traps, or traps that had a cascade? he asked this question because he believed that traps with a cascade impede the velocity and are the cause of many stoppages in the trap, especially in small tenement houses where hard paper was used. The paper opened wide in the water in the trap, and the next flush of water instead of sending the paper through the trap, fell on the outer edge of the paper and turned it over and over piece after piece until a ball was formed, with the result that the drain was choked. Many old drains had been opened up and an old fashioned siphon found placed therein, no one knew it was there until the drain had been exposed for the purpose of fixing a trap in it. This bore out his statement that traps with a cascade were at fault.

Dr. Butler replied he was sorry he was unable to supply that information a note not having been made at the time.

Dr. Sydney Davies (Woolwich) who was unable to attend, wrote saying he was decidedly opposed to the general abolition of intercepting traps. If all sewers were perfect in construction, perfect in form, and perfectly flushed there would be no need for the intercepting trap, which would in that case be nothing but an obstruction to the removal of house drainage, but he thought that until that ideal condition of the sewers arrived, of the two evils, escape of sewer gas in the neighbourhood of the houses, and the slight impediment to the getting away of house drainage offered by the trap, the first must be considered decidedly the greater. Occasionally no doubt some nuisance arose from an intercepting trap, but he found, on careful euquiry, that in his borough any such nuisance was exceptional. The Borough Engineers who advocated the abolition of the trap did so, he understood, not so much because they considered it objectionable in itself, as because they wish to ventilate the sewers through the house drains. Their very reason then for asking for its abolition was an argument against the proposal. If the sewers needed so much ventilation, the sewer gas must be decidedly objectionable, and should not escape in the neighbourhood of houses. The object of the Borough Engineers should be not to obtain general ventilation of sewers, but to so improve the sewers, and so flush them, that no ventilation was needed except for those sewers in which men must work. These of course must be separately considered, and special means taken for their ventilation, but not by tapping them at every house. He was surprised to find that Dr. Butler was a convert to the view generally held by the Borough

Engineers as to the desirability of making every house assist in ventilating the sewers. About ten years ago he (Dr. Davies) read a paper before the British Medical Association on Ventilation of Sewers, in which it was maintained that more ventilation did not mean less foul gas in the sewers, but rather the contrary. He quoted Mr. Baldwin Latham as follows: "If they allowed large volumes of pure air to pass through a sewer in contact with sewage, they had large volumes of foul air escaping at some point, and that the great secret in sewer ventilation was not to encourage these currents of air through sewers, but to give such an amount of vent as should prevent any pressure being exercised upon the traps of their houses, so as not to allow any escape into the house itself." He did then, and still endorsed this view, which he thought had of late years gained very general acceptance. Dr. Butler assumed just the opposite, that sewer gas could be made innocuous simply by unlimited ventilation. Let him examine any slowly flowing dirty ditch which was altogether exposed to the open air, and note whether this complete ventilation abolished smells. No doubt it would be better if intercepting traps could be dispensed with, but as long as the sewers were worse laid and worse flushed than the house drains they were a necessity, and to ask for their removal in order to improve the sewers was like a man asking his adversary to lay down his armour in order that the foeman's wrath may be appeased.

MR. P. SAUNDERS (Croydon) said he should like to say a few words on a point not mentioned by the previous speakers. Dr. Butler did not give them, as a result of his very exhaustive inquiries, the number of ventilation pipes that were found stopped; Dr. Butler was, he understood, an advocate for the abolition of the disconnecting trap, and Dr. Sanders was of the same opinion, "because they stink." Now in his experience, he had invariably found when an offensive smell was emitted from the fresh air inlet, it was because the ventilation pipe at the end of the drain was obstructed, or was too small. Years ago many 2 in. and 2½ in. zinc vent pipes were fixed, these were now frequently found bent over at the top, effectually sealing them; also the more modern 4 in. iron pipes are found completely stopped with rust, etc, in the bend at the foot. In these cases would it be advisable to do away with the disconnecting trap? He thought not: as any defect in the drain under the floor, or soil pipes in the house, would certainly be more dangerous.

MR. R. READ (Gloucester) remarked that the effect of the interceptor was to cause an obstruction something like 8 ins. in depth in the flattest length of the drain, the result being that the sewage merely dribbled into one end of the interceptor and out at the other. There was no rush because the interceptor was at the end of a comparatively flat gradient, and as long as they had that almost stagnant sewage in the trap they would have sewer gas in the drain. The sewers were what the drains made them, and the unfortunate borough engineer had to waste water in flushing otherwise clean sewers, to try and

get rid of smells created in the drains by the interceptor: it was like hunting a ghost, or will o' the wisp, for an hour later the smell would be as bad as before. If the valve of the so-called air inlet held tight, the drain air was forced through the water seal of the trap by every discharge from the drain, but if it did not hold tight, a portion of the drain air must be forced through it in front of the door and windows, and the remainder through the trap into the sewer. On the sewer side, if the sewage in the sewer rose over the mouth of the drain junction, the sewer air was forced through the water seal of the trap, or blew out the stopper of the raking arm, to escape either at the fresh air inlet, at the soil pipe ventilator, or both. But omit the trap, and the drain could be given a better fall, the sewage would have a clean run through both drain and sewer, with a good velocity, and the ventilation could be properly applied and adjusted. The trap in its present position was like a single policeman trying to stop an unruly crowd, he got knocked over, but its prototype the trap of the w.c. pan was in its proper position, and like a policeman directing the traffic quietly into its proper channel, that is, it prevented the drain air from passing through the w.c. pan, by directing it up the soil pipe ventilator. With the interceptor in its present position they could never secure proper or efficient ventilation, for in order to thoroughly control the ventilation of a sewer, the number of outlets must be largely in excess of that of the inlets, and so distributed over the whole system, that the manhole gratings on the surface of the road should always be made to act as inlets, by the combined action of the soil-pipe ventilating outlets.

Dr. Butler wished to join with Mr. Read in expressing his appreciation of the manner in which their papers had been received. They could not complain of lack of criticism, but that criticism had left him more convinced than ever of the truth of the position he had taken up. It was true that if Mr. Roechling's standard of what would suffice to condemn the interceptor were adopted (namely, that in *every* case it must be proved an unmitigated nuisance) their task was a difficult one. But he submitted that the failure of the disconnecting trap to achieve its object in so large a proportion of cases as he had been able to establish, and its direct responsibility for the gross insanitary conditions he had observed, constituted a serious impeachment of the system. Mr. Roechling had urged that in the absence of the trap, sewer gas was systematically laid on to the houses. His (Dr. Butler's) position was a denial of this proposition, while he affirmed that the trap and the complications it necessitated were a contrivance by which sewer gas actually was laid on to the houses in an ascertained 10 per cent. of the cases. It was a pure assumption that drain air and sewer air were essentially different, and that the one was necessarily less dangerous than the other. As Dr. Sanders in his remarks had pointed out, they were discernibly the same, even while subject to distinction merely by a legal quibble. To admit the aerial contents of the sewer to gas-tight house

drains with no untrapped openings was not, he maintained, to lay on sewer gas to the houses, as had been contended. This assumption was at the root of the objections to doing away with this insanitary contrivance. So far from the intercepting trap being a tell-tale, as had been suggested, what so frequently happened (as Mr. Read had pointed out in his paper) was that upon the trap becoming choked, the head of sewage in the drain and manhole was sufficient after a time automatically to force the stoppage, and thus relieve the condition without anyone being the wiser. But the pollution of the site by the percolation of liquid sewage was an unsuspected danger that remained. He was aware of the fallacies that lurked in crude statistics, and when he came to the relative incidence of diphtheria upon the respective areas in his district in which the drains were and were not equipped with interceptors, he wished to give the facts only for what they were worth. But the facts were that in the older part of the district, built for the most part prior to 1875, where the housing conditions generally were much more insanitary than in anything to be found in the newer part, and where the general death-rate was considerably higher, the incidence of diphtheria had been materially less. If there was one disease more than another supposed to be associated with emanations from drains and sewers, that disease was diphtheria. And the fact was that in Willesden diphtheria had by far its greatest incidence upon the population living in houses provided with interceptors, notwithstanding that generally their sanitary conditions were otherwise greatly superior to those so unprovided. In the one class, that provided with interceptors, there was a particular provision in the form of an untrapped opening to the drain, situated near the ground level, in the forecourt, by which drain air and, very frequently, sewer air were laid on at the thresholds of the houses. In the other, no such ingenious device for polluting the atmosphere of the house existed. The different rates of incidence of diphtheria might not be significant of this difference, but their causal correlation would only be in accord with prevailing notions as to the relationships of diphtheria and exposure to the emanations of drains and sewers. What he wished particularly to insist upon, however, was that the interceptor and its appurtenances, when critically examined, were found to be devices for doing what they aimed at avoiding, namely, providing an escape near the openings to a house of the emanations from drains and sewers.

MR. W. D. SCOTT-MONCRIEFF (London) writes to express his regret that he was unable to be present at the discussion upon the two papers by Dr. Butler and Mr. Read, which he considers at any rate courageous if they are not conclusive. He thinks that in the first paper there are several statements that may be fairly met by a direct negative and a good many conclusions which are in no way justified by the facts. Dr. Butler says that the conception of a drainage system in which the drain is disconnected from the sewer is faulty in theory, because it is based on the assumption that it is safe to have a condition of things in the

public sewers that is unsafe to have in the house drains. Now this is simply not the case. The unventilated condition of town sewers is universally recognised as being for the most part unsatisfactory, and the trouble is how this defect may be remedied. The problem has proved difficult to solve, and until the remedy has been applied, the practice has been quite a sound one, of making sure that the conditions prevalent in the sewers should not be allowed to invade the interior of the dwelling. This position in the judgment of the great majority of experts is the best available, and it has been developed at an enormous cost to the community. The remedy advocated by the two writers of the papers is that of doing away with disconnecting traps, as an end of the trouble. The question is, have they proved their case? Proving the existence of defects in the system now in vogue by no means establishes their proposal for the abolition of disconnecting traps as a certain remedy. The problem of sewer ventilation is so complicated and so difficult of solution that it will be necessary for the writers to be able to point to a case carried out on a large scale not even upon average, but under exceptionally unfavourable conditions, in which the success of their proposals has been proved to the hilt; so far as the papers are concerned, they have not referred to a single case in which they have even been tried. While giving every credit to Dr. Butler for the investigation at Willesden, which involved no less than 6,745 inspections, it is obvious that even if the number had been doubled it would not have done anything to prove the efficacy of their alternative proposal. The defective character of one system does not by itself prove the efficacy of another. My own experience now goes back as far as an inspection of the original arrangement by the late Dr. Fergus at his own house in Glasgow, from which Mr. Buchan designed his well-known trap. This established the principle of house disconnection which I had already advocated, and which has since been almost universally accepted. There is not a shred of evidence in either of the papers to show that in certain states of the atmosphere there would be any movement whatever through the house drains and ventilating pipes of the emanations from the sewers, or that the street gratings would, under certain conditions prevailing during calm weather, be inlets for fresh air any more than they are at present. Under such conditions the emanations, however objectionable they may be, are at any rate better removed by the width of the pavement and half the width of the street from the houses, than hanging about the roof of the house itself and contaminating the atmosphere in the neighbourhood of bedroom windows. It is a matter for regret that Dr. Butler did not take the opportunity presented by the investigation at Willesden to provide information as to the causes of the large percentage of choking which occurred in the disconnecting traps. Presumably the houses are occupied by people who are not very particular about their drains, and certainly six-inch pipes are too large for that class of property. The general experience with regard to properly constructed disconnecting traps is that they contain clear water after they have been adequately flushed, and, in

any case, the objectionable contents mentioned by the writers do not disappear by discharging into the sewers, where they will still engender smells and gases, which the writers propose to pass through the soil-pipes and ventilate at points much nearer to windows than the street gratings. The disappearance of the plugs from the cleansing eyes of the disconnecting traps to which reference is made is a simple matter of carelessness. The objections raised to large manholes have long been recognised, and are met by cast-iron manholes with covers at the bottom of the manhole. A much more serious question than the presence of offensive gases in the sewers is the system now in vogue of spraying enormous volumes of sewage into the air in districts that are densely populated.

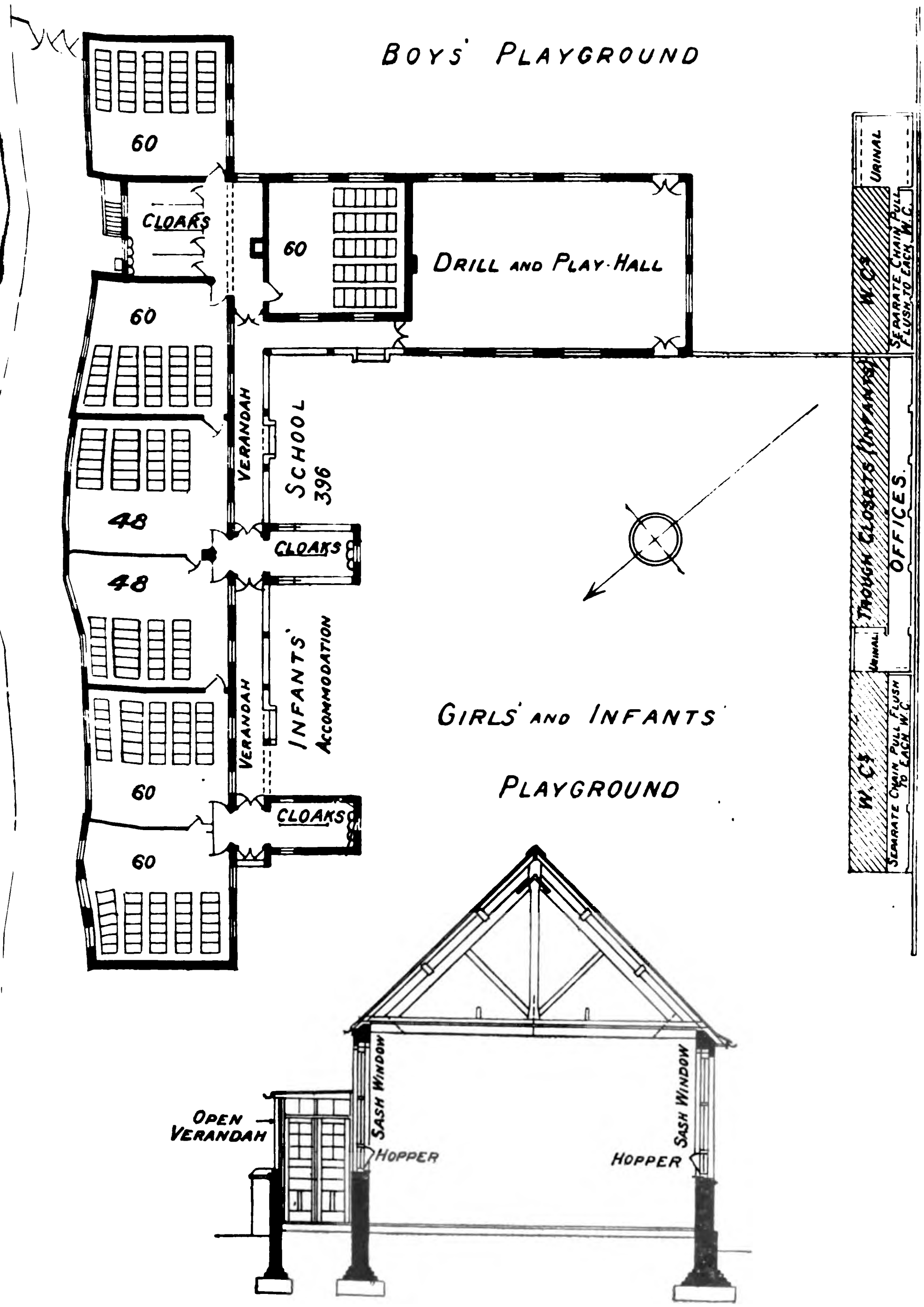
STAFFORDSHIRE TYPE OF ELEMENTARY SCHOOL.

By GEO. REID, M.D., D.P.H.,
Medical Officer of Health, Staffordshire County Council.
(FELLOW.)

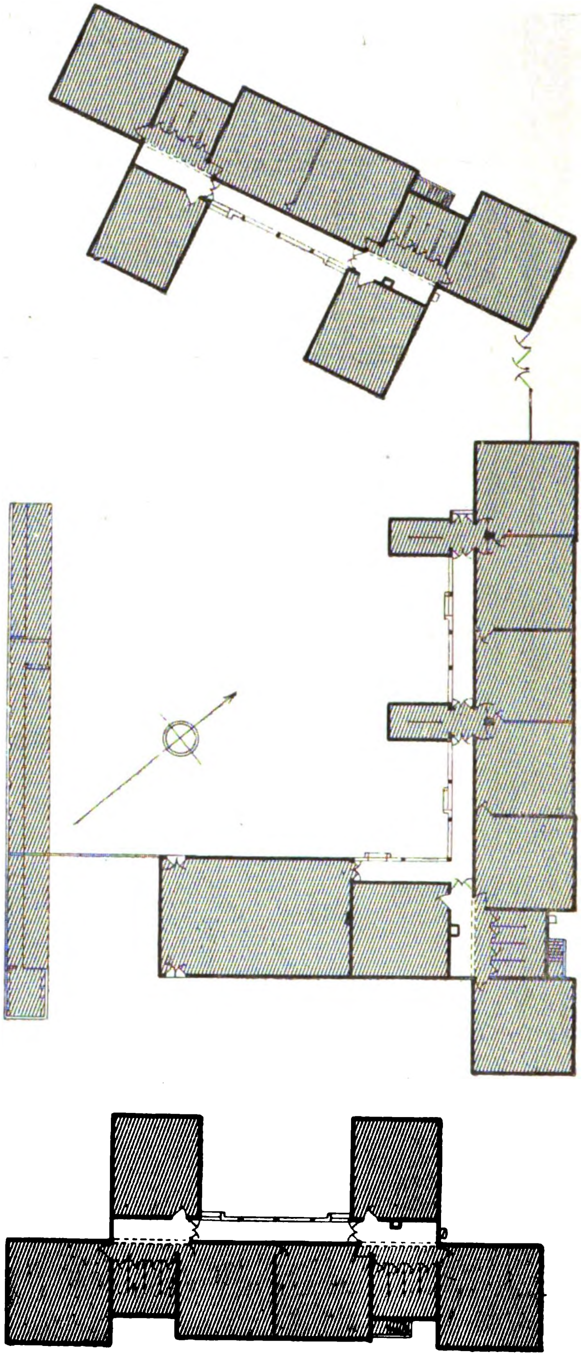
AT the request of the Council of The Royal Sanitary Institute, I have pleasure in submitting for publication in the Journal the accompanying plan of a new type of school now adopted by the Education Committee of Staffordshire, together with a short reference to the special features of the plan, and an account of the reasons which led to its adoption.

All plans of proposed new school buildings and of suggested alterations in existing buildings within the jurisdiction of the Staffordshire Education Committee have, in accordance with standing orders, to be submitted to the County Medical Officer of Health for approval from a health point of view. In considering the first set of school plans submitted to me under the new order of things, the difficult question as to how adequate provision could be made for ventilation by natural means if the type of building hitherto in favour was to be maintained at once presented itself, and I was given to understand that the type in question, namely, the central hall type, had come to be regarded as essential from an educational point of view. Having failed to find a satisfactory way out of the difficulty, I advised the Education Committee that if the central hall arrangement must be maintained, the adoption of mechanical ventilation, objectionable in my opinion though it was for more reasons than one, became imperative. I am glad to say that the Education Committee declined to entertain the latter suggestion, and having thus come to a deadlock they instructed their architect, Mr. Hutchings, to confer with me with the view, if possible, of arriving at some plan by which adequate natural ventilation might be secured without sacrificing educational requirements.

This led to numerous alternative plans being considered, in all of which the central hall principle, in modified form, was adhered to, while, at the same time, cross window ventilation was somewhat imperfectly


BOYS' PLAYGROUND
60
CLOAKS
60
DRILL AND PLAY-HALL
60
VERANDAH
SCHOOL
396
48
CLOAKS
48
INFANTS' ACCOMMODATION
VERANDAH
60
CLOAKS
60
URINAL
W.C.S
SEPARATE CHAIN PULL FLUSH TO EACH W.C.
TROUGH CLOSETS (INFANTS)
OFFICES.
URINAL
W.C.S
SEPARATE CHAIN PULL FLUSH TO EACH W.C.
GIRLS' AND INFANTS' PLAYGROUND
OPEN VERANDAH
SASH WINDOW
HOPPER
SASH WINDOW
HOPPER

SECTION.



Ground Plan of School.

provided for. But we found that to secure even this much, educational requirements had to some extent to be sacrificed, and it was also evident that the buildings would be far more costly.

Under these circumstances, I strongly urged the Committee to reconsider a proposal I had previously made, namely, the adoption of a plan of building in which one semi-detached hall would serve for three departments, the class-rooms being designed in pavilion form with verandah communication. This suggestion again met with considerable opposition, but as the practical difficulty of providing adequate ventilation in the case of the central hall type of building became more and more apparent to individual members of the Committee, the view that, after all, that type might not be so essential from an educational point of view as was supposed began to gain ground, with the result that the Committee ultimately not only accepted the new proposal, but became enthusiastic advocates of it, and succeeded in inducing the Board of Education to sanction the erection of two schools of the new type.

It will be seen from the plan that there is ample provision for cross window ventilation, each window being provided with large hopper openings about 5 feet from the floor level and sash openings above. It is intended that under ordinary conditions of weather the former shall all be permanently and fully open, while the sash openings will allow of the free flushing of the rooms during play and meal intervals in accordance with the following rules laid down by the County Education Committee:—

> "The openings provided for ventilation must always be kept freely open, being regulated in accordance with the weather, but they shall never be entirely closed.
>
> "Apart from the ventilation openings, during play intervals the windows on all sides of the class-rooms must be freely open for at least five minutes, and immediately following the morning and the afternoon attendances, the windows must be kept freely open for at least fifteen and thirty minutes respectively.
>
> "Apart from the ventilation openings, it should be the routine practice while the class-rooms are actually occupied to have the windows as freely open as the weather permits."

The buildings throughout are to be heated by low pressure ventilating radiators. Each department of the school will have an entirely distinct circuit, and in order to compensate for the free ventilation and systematic air flushing of the class-rooms, a mean heating surface of from 17 to 20 feet per 1000 cubic feet will be provided. It is anticipated that with this liberal allowance it will be possible, with intelligent stoking, to insure that the walls shall retain their heat and thus prevent the undue lowering of

the temperature of the class-rooms by the frequent air flushing by freely open windows, a practice to which I attach the greatest importance, having regard to the limited space per child required by the regulations of the Board of Education and to the prohibitive cost which any material increase of space would entail.

Besides the window and radiator openings, no special so-called inlets and outlets are provided except in the case of one of the class-rooms, where, at the request of the Board of Education, roof ventilators will be fixed for experimental purposes. The air of this class-room and of others not provided with such ventilators will be analysed periodically for the information of the Board, and if it should turn out that the roof ventilators prove to be advantageous (a result which I do not anticipate), the County Education Committee have given an undertaking to the Board to have similar ventilators fixed in the other class-rooms.

Incidentally it may be mentioned that the closet accommodation consists of ordinary water-closets for the boys' and girls' departments, and trough closets for the infants' department. This is now the established rule throughout the county in districts having public water supplies and sewers, and the arrangement is found to answer admirably.

When the new type of school was under consideration it was estimated that the cost of erection would amount to about £2 per child less than the central hall type. The actual reduction in cost, however, has been found to be considerably greater, tenders having recently been accepted for two schools of the new type to accommodate 1,020 and 628 children respectively at a total cost per head in the former case of under £10 10s. and in the latter £11 1s. (excluding cost of site in both cases), as compared with about £15, which was the average cost per head of the central hall type of building, now discarded in this county.

Volume XXVII. No. 4. Issued May, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONFERENCE ON SMOKE ABATEMENT.

Friday, December 15th, 1905.

SUBJECT: **"ADMINISTRATION, LEGISLATION AND NECESSARY REFORMS."**

ADDRESS

By SIR WILLIAM B. RICHMOND, K.C.B., R.A.

IN the presence of so many scientific authorities, whose practical abilities are such as I have no claim to, it would seem most desirable to further the objects which we have in view if I offered such expert evidence as has come before me in a long experience. But while I do this, I cannot refrain from expressing my convictions upon ethical as well as æsthetic principles. Both are merged together, or anyhow come into touch somewhere.

We all know that light gives life and colour, we all know that flowers lose their brilliant tints if placed in a dark cellar. Man is a kind of flower, he too loses his colour in a dark prison. Pictures become black or deep yellow if shut up in a case for any lengthened period; this has been always known to artists. There is a letter still extant from Rubens to a friend whom he requests will have a picture which he has despatched to be immediately taken out of the case and placed in the "sun" that it shall recover its clearness and brilliancy of colour. The Venetian painters, as we all know, were the great colourists of Italy, hence of the world; it is related of Titian by a contemporary writer that it was the habit of the master to place his pictures to dry in the sun, exposing them to it from the roof of his house in Venice, that he also allowed his pictures to remain out all night that they might receive the benefit of the dew of the morning mists. Both these experiments I have tried with disastrous results. It is important

that oil, whether linseed or poppy, shall dry quickly, otherwise it becomes sour and the carbon in it if not quickly dispelled forms a coat of opaque lustreless black as a skin over the surface of a picture. The effect of dew is that it purifies the oil, being in the nature of a solvent of impurities. Some one more learned in science than I am will be able to tell the conference why this is so, I only advance my experiments for consideration. There are many other technical topics on which I could dwell, but this is neither the time nor place except to mention them superficially. There was held some forty years ago a Royal Commission, the late Prince Consort was chairman, to consider the desirability of transferring the whole collection of pictures in Trafalgar Square to South Kensington. Many experts in various matters were examined before the commission, among them Faraday gave evidence; my father, who sat on the commission, told me that Faraday said, "Every smut, however small, which remains upon the surface of a picture, even if the colour is dry, leaves behind it a greasy matter, so potent, that it can only be removed by a *solvent* of such a strength which being applied will eat into the surface of the paint."

Owing to the poison in the atmosphere of smoky cities, the most noble and the most durable of all methods of painting, "Buon Fresco," is out of the question. During the period of the crystallisation of the lime in concert with the pigment not superposed but incorporated into it, if there is gas about, or any other poison, the lime is injured, and the marriage between the lime and the powder of the pigment is only partial, hence in time the colour, together with the only partially crystallised lime, falls off or can be dusted off. Briefly I will tell the conference what Buon Fresco is. The wall upon which it is to be applied must be thoroughly dry. Upon this dry wall a thin layer of lime and marble dust liquid and ground is applied, but only upon the portion of the painter's design which he intends to complete in a morning. The colours are ground in water, but the water must be pure; any water which is in the slightest degree poisoned with gas or any other enemy to lime must be avoided. The water must be boiled before using. Water is the only liquid used in Buon Fresco, save perhaps a little wine or fine vinegar. The lime does the fixing! You will see at a glance that in this, which appears at first sight to be a frail material for fixing, but which is in truth a very strong binder, the slightest enemy to its adhesive or binding power will be fatal.

Coal smoke is fatal to the proper hardening of lime, even upon lime-plastered walls which have no decoration applied to them.

The failure to be permanent of the Frescos in the Houses of Parlia-

ment is mainly due to two causes: to the contact of the lime with gas and other poisons; and to an inadequate incorporation of the pigments within the strata of lime, and among the angles and surfaces of crystallisation.

But in the country, given that the walls of a building are quite dry, and that there is pure water to be had and no gas works near, there is no reason why Buon Fresco should not be as permanent in England as in Italy. But until we rid London from the poison of smoke, Fresco painting can never be practised with security.

Now let me briefly pass on to the effect of coal smoke on marble and bronze. Marble is poisoned by it and rendered powdery, the same action of the greasy residuum which we have noticed as applied to paintings acts upon the surface of the marble. The absolutely priceless Greek, Assyrian, and Egyptian works of sculpture in the British Museum are slowly but surely decaying. That exquisite "surface" so dear to the craftsmen of old is fast becoming granular. Washing in the water is of little use; water will not remove the essential oil deposited by poisonous smuts. Glass will protect the surfaces in a measure if it is hermetically sealed so that poison cannot enter. Precious manuscripts are liable to the same deterioration. Bronze is easier to tackle with, because bronze can be cleaned with a solvent; but even here we are in difficulties, because the "surface" of the bronze upon which is dependent so much of its beauty is eaten into by the poisonous particles. All metals, even gold, are similarly injured.

Stone decays under the same causes; upon the lintels of windows inside as well as outside St. Paul's Cathedral is deposited in places a thick layer of solid smoke, sulphur and what not, and this layer is constantly active, it is alive with acid which is devouring the stone and causing it to decay into powder.

Now does this matter, that is the question. Our National Gallery is worth millions of money, our British Museum and South Kensington are likewise worth millions, this is obvious; but private collections in London and in other dirty cities are also priceless; putting the matter upon the lowest ground of commercial interest, I ask, is it wise to risk a certainty of destruction which must come sooner or later if public opinion does not *push* and by unanimity force that impenetrable Talking House to legislate firmly and surely. Royal Commissions do not go for much, they appear rather to feed the inactivity of our legislators than urge them to something certain and practical. Too much discussion sometimes ends in smoke in the sacred walls of Westminster.

Pressure from the *outside* is the only chance for reform in our Army as well as of other grave matters. Public opinion when once it becomes unanimous is the government, and that is the use of democracy. How to set about to wake up a sleeping body except by exposing its inertia and stimulating it to waken up by jogging it constantly it is not for me to say, but I gather that to-day we may consider how far some conclusive Bill may be brought before Parliament to at least minimise a nuisance almost if not entirely unnecessary and certainly, again speaking of commercial interest, excessively expensive.

But in offering a Bill to Parliament we must watch it with the eye of a lynx lest it be pruned down by sophistry and weakened at every point to provide possible loop holes of exit for persistent offenders.

In conclusion, I wish this conference success; unity is strength, and now that the Coal Smoke Abatement Society and The Royal Sanitary Institute have joined hands I fully believe that the voice of the country, both through the Press, the organ of democracy, and among individuals, will rise in volume and give its sanction to some scheme of legislation by which the 20 per cent. of smoke in our fogs shall become a matter of "the past."

A PLEA FOR A SYSTEMATIC COMPARATIVE ANALYSIS OF THE AIR OF TOWNS AND A CONSOLIDATION OF THE LAW DEALING WITH SMOKE EMISSIONS.

By Sir JOHN URE PRIMROSE, Bart.

I HAD the honour of commenting on the important problem of Smoke Pollution and its Abatement, before the Municipal Conference at the Congress held by the Institute in Glasgow in July, 1904, and I thank the Council for again permitting me to explain my views before this important Conference. Although not a technical expert, I may, as a past municipal administrator, be able to make some practical suggestions, which, if persistently followed up and pressed by such influential bodies as your Institute and the Coal Smoke Abatement Society, shall finally result in the reduction of our serious aërial contaminations. Glasgow, the city I represent, has the reputation of being a smoky town. Every stranger has a fling at her for three things, her variable climate, her offensive river, and her smoke-laden atmosphere. We cannot alter the first; the second will soon be a thing of the past; and of the third, I submit, the said stranger can have little relative knowledge. We do not plead guilty to being a smoky city, because guilt in this case must be comparative.

The atmosphere of a manufacturing town cannot be fairly compared with that of a purely residential town, still less with the air of a country village or hamlet. Three standards seem necessary to be established before any one is entitled to say that inhabitants are unduly suffering in health or in amenity from a smoke-polluted air. Although we already possess standards for many things, such as sewage and manufacturers' effluents, acid and other noxious exhalations from works classed under the Alkali Acts, the amount of water and fat in milk, the quantity of butter in margarine, the quality of drugs and such like: we have not yet arrived at even the serious consideration of a suitable standard for city or town air. Air, in which

we are, so to speak, bathed (submerged from morning till night) and in which "we live and move and have our being," may be anything so long as it can be breathed at all, with the exception I have named (the provisions of the Alkali Acts) and excepting also the public health provisions as to "unwholesome trades," when local by-laws can prohibit noxious contamination of the atmosphere. In each of these instances the sense of smell is offended, and the nuisance is palpable. But with a smoke-laden air this is not the case to any serious extent, except when fog is also present. Yet we have abundant evidence that a smoky atmosphere is inimical to health, conducive to depression, and destructive of plant life, as well as of building material.

In the face of experience, we ask "Why is there no standard for towns in regard to smoke pollution?" The answer seems to be that town-dwellers are ignorant of the extent of the pollution, and sanitarians and scientific men have not yet made continued investigations in the cities with a view to enlighten them.

It is true we have had many Conferences, exhibitions of mechanical and other apparatus for the prevention and modification of smoke in steam, boiler, and other furnaces; but I am acquainted with only one serious, sustained, and systematic effort by a thoroughly scientific man to bring the subject home to the public in a comprehensive and lucid manner. I refer to the work of Dr. Angus Smith on "Air and Rain." His investigations were mostly confined to Manchester and district, and similar ones should be instituted in every town of any importance in the United Kingdom, as no one at present knows how London compares with Liverpool, or Birmingham with Glasgow.

That sorrow-inspiring book, "The People of the Abyss," refers on page 44 to some calculations made by Sir William Thistleton-Dyer, on the smoke pollution of the air of London, and on these calculations London is in a worse position than Glasgow. It appears "*from his study of the smoke deposits on the vegetation, that six tons of solid matter, consisting of soot and tarry hydro-carbons, are deposited every week on every quarter of a square mile in and about London,*" or 39·66 cwts. per annum on each acre. In Glasgow for the past three years the chief sanitary inspector, who is responsible for the abatement of the smoke nuisance, has kept dust-gauges on the roofs about 30 feet above the street level for 100 days, in each of the 25 wards of the city, submitting the contents for analysis to the corporation analyst. At the 1904 meeting of the Institute in Glasgow, I submitted a table showing the results of these analyses of exposures

from the 1st of March until the 8th of June, whence it appeared that in the spring months the smut-fall averaged 22·119 cwts. per acre per annum. From the 1st November, 1904, to the 8th February, 1905, there is an increase over the previous test of 4·53 cwts. per acre per annum, or 25·649 cwts. as against 22·119. The *mineral matter* is not higher, most of the increase being due to the "*organic matter not soluble in ether*," or, in other words, the pure soot, while it is stated that the most deleterious and defacing agent is the *grease*, or, as expressed in the table, the "*ether-soluble hydro-carbons*," an oily matter of a dark brown colour, known only too well in damp, foggy weather, by the feeling experienced beneath the feet, as if barrels of oil had been smeared over the pavements.

Parallel to this "smut-fall in Glasgow" in spring and winter, I desiderate that similar experiments be made in London and the large towns in order (1) that notes may be compared, (2) that the education of the public may proceed on exact and scientific lines, and (3) that some reasonable standard may finally be adopted for a town's air, beyond which pollution may be considered flagrant and reprehensible. At present information under this heading is in a chaotic state. To know the amount of solid particles in the air of any town from year to year, and at different periods is, I hold, most important, also to know periodically the constituents which are thrown down by a day's rain. Ammoniacal, nitrous, sulphurous, carbonic and other vapours and gases are continually rising from a city to pollute its atmosphere, and obtaining a collection of dust in gauges does not enable us to ascertain the nature or amount of the gaseous and volatile impurities. Hence on wet days as much of the rain as possible should be caught in various parts of a city, and submitted, while fresh, to analysis. Angus Smith's experiments in this way indicated an appreciable amount of free acid in the air of towns.

The same method has been recently practised in Glasgow. On the 26th of October, 1905, ten wooden boxes, in groups of two, were placed in the centre of each main division of the city, on roofs about 30 feet above the street-level and beyond interference. Rain fell all day heavily; consequently, sufficient water was collected for a satisfactory analysis. The analyst found no trace of free acid, showing that, whatever may have been the case in Dr. Angus Smith's day, we are apparently now free from the irritating acid vapours which used to escape unhindered from the alkali and kindred manufactories. This is a most important fact, and it would be well if it could be corroborated or assailed by similar experiments in other towns.

It may be explained that this box was mounted on a roof practically in the centre of the cattle market and public abattoir of the city, where the air is certain to be impregnated with organic vapours from the bodies of the animals, from cattle-lairs, pens and slaughter-houses, and the figures given by the public analyst are only what might be anticipated by common sense. The solids in suspension, which may be taken to represent fairly the smokiness of the locality, are not in appreciable excess compared with the others.

As to the consolidation of the law dealing with smoke emissions, the most casual glance at the various Acts of Parliament under which municipal authorities are now working shows the disparity that exists between them.

Speaking generally, all but one of the Acts appear to give power to abate the smoke nuisance, and then, by the use of certain limiting expressions, permit a loophole of escape. Section 23 of the Public Health (London) Act, 1891, is a good example of this. Sub-section (4) seems to emasculate the powers previously conferred by enacting that "the words "consume or burn the smoke" shall not be held in all cases to mean "consume or burn all the smoke;" and the court hearing an information against a person may remit the fine, if of opinion that such person has so constructed his furnace as to consume or burn, *as far as possible*, all the smoke arising from such furnace, and has carefully attended to the same, and consumed or burned, *as far as possible*, the smoke arising from such furnace."

A Glasgow deputation, which came to London in 1904 on this subject, were informed by Mr. Alfred Spencer, of the London County General Purposes Department, that this section, and Section 24 (*a*) of the Act were "so crippled by those qualifying words that it was very difficult to obtain convictions under them, and consequently they were not used," and the London sanitary authorities had to issue their complaints under Section 24 (*b*), which runs: "Any chimney (not being the chimney of a private dwelling-house) sending forth *black smoke* in such quantities as to be a nuisance."

In face of such a statement as this, further criticism may well be considered needless; but as all law is supposed to be based on common-sense, we are bound to inquire whether a furnace, properly constructed and carefully attended to, may yet produce black smoke or any smoke. If the answer to this question be yes, then the limiting words are necessary to protect innocent people. If the answer be no, then the limiting words

should be struck out, and the issue of smoke from any steam-boiler or such-like furnace made absolutely a contravention. Whether yes or no is the correct answer here, I would prefer to leave to the engineering and mechanical experts. My experience as a manufacturer would lead me to answer no, as I have been able, by the appliances in my own boiler furnaces, to work them day and night without any smoke. Moreover, it has to be borne in mind that a furnace may be perfectly constructed, and properly managed and fired, and yet cause smoke from two causes not noted in any of the Acts, viz.: (*a*) insufficient draught, and (*b*) the use of a low-class bituminous fuel.

The first defect may be caused by defective flues or a defective chimney, neither of which, so far as I am aware, comes under the definition of the word "furnace." In either of these cases a person may quite easily prove he had excellent furnaces, up-to-date in every respect, and that his fireman fired them in a manner above reproach, and yet smoke was the result; in which case, under Acts framed in this way, he would escape conviction.

Our Act in Glasgow, although perhaps not an ideal one, avoids this mistake by making it compulsory upon a respondent to prove, not only that he has constructed his furnaces so as, as far as possible, to consume the smoke, and carefully attended to and managed them in a proper manner, but also "that he has used the best practicable means for preventing smoke," thus covering defects in chimney, flues, or any other part of his steam-raising or heating installation. True, nothing is said as to the quality of the fuel, but, in my opinion, no person should be permitted to burn a low class and smoky dross or slack in any furnace, no matter how perfectly constructed or how well fired, and escape the meshes of the law if the result is black smoke.

I said at the beginning of this part of my paper that there was one exception to this unsatisfactory state of the law. Every town but Nottingham suffers more or less from the qualifying words I have alluded to. In this town the law seems to be simple and perfect. Permit me to read to you Section 76 of the Nottingham Improvement Act of 1874. It is in the following terms:—

"76. For prevention of smoke, the following provisions shall have effect (that is to say):

1. If any fireplace or furnace employed, after the commencement of this Act, in the working of engines by steam, or in any building used for the purpose of trade or manufacture, or baths or wash-houses (although a steam-engine is not used therein) is not so constructed as to prevent or burn the smoke arising from such fireplace or furnace, the owner or occu-

pier of the building or lands in or on which such fireplace or furnace is situate shall be liable to a penalty not exceeding ten pounds, and to a further penalty not exceeding forty shillings for every day during any part of which any fireplace or furnace is so employed without being constructed so as to prevent or burn the smoke arising therefrom:

2. If any such owner or occupier, after the commencement of this Act, negligently uses, or permits to be used, any fireplace or furnace so constructed as to prevent or burn the smoke ariisng therefrom in such manner that the smoke arising therefrom is not effectually prevented or burnt, he shall be liable to a penalty not exceeding ten pounds, and to a further penalty not exceeding forty shillings for every day during any part of which such fireplace or furnace is so continued to be used:

3. If any engineer, fireman, stoker, foreman, or other person negligently uses any fireplace or furnace constructed so as to prevent or burn the smoke arising therefrom in such manner that the smoke arising therefrom is not effectually prevented or burnt, he shall be liable to a penalty not exceeding forty shillings:

4. The foregoing provisions of this section shall extend to cases where more fireplaces or furnaces than one communicate with a single chimney, and in any such case the names of the several owners and occupiers of the buildings or lands on which they are situate, and the several engineers, firemen, stokers, foremen, or other persons having the control or management thereof, may be included in one summons, and the justice before whom the case is brought may, in his discretion, apportion the penalty as he sees fit, or impose a penalty on one or more of those persons in exclusion of the others:

5. If any such owner or occupier, or the servant of either of them, refuses to allow such building or lands to be inspected by a person authorised by the Corporation, then any person so authorised may, by warrant under the hand of a justice (which warrant any justice is hereby authorised to grant) enter into and upon such building or lands, and examine any such fireplace or furnace."

Here we have no qualifications nor limitations. Moreover, under Subsection (3), the stoker or fireman may be the convicted party and not the master or firm, which appears to me to be perfectly just, and on all fours with the terms ot the Alkali Act, by which, if the issue of acid vapours be in excess of what is prescribed, the careless employee is made responsible, if in the opinion of the inspector, the apparatus of the manufacturer is in perfect order.

I am informed by the Chief Sanitary Inspector of Glasgow that over 90 per cent. of the complaints of excessive smoke taken against manufacturing firms there, are caused by careless firing on the part of the stokers. Such a state of matters calls for reform. I can see no essential difference between the careless issue of acid vapours from perfect machinery in a work classed under the Alkali Act, and the careless issue

of smoke from properly constructed furnaces attached to suitable flues and an adequate chimney.

I now leave the discussion in your hands. The law, to my mind, is deficient as it stands at present. It needs amendment, but it also needs consolidating. The manufacturers in one town should in this respect be placed in an equal position with the manufacturers in every other town; otherwise legislation against this evil will be partial, wanting in precision, and will operate unequally and unfairly. I trust this important Conference will help to bring about both amendment and consolidation of the law, and to this end I plead for a systematic and persistent education of public opinion, both by The Royal Sanitary Institute and the various important local authorities throughout the country.

NOTE ON

THE PROPOSED AMENDMENT OF SEC. 24 (SUB-SEC. 6), OF THE PUBLIC HEALTH (LONDON) ACT, 1891.

By JULIAN S. CORBETT, LL.M., F.S.A.,
Barrister-at-Law.

THE wording of this section has always been a stumbling block. Difficulties have constantly occurred in proving that the smoke complained of was "black." As a matter of optics no smoke in daylight can be "black," and therefore it is clear that the section contemplates smoke of a density which more or less nearly approaches "black." Here then at once arises an uncertain factor, and in each case a successful prosecution depends upon what degree of density will in the opinion of the particular magistrate satisfy the legislative conception of "black." Municipal inspectors are equally human, and no means exists of defining the word "black" in such a way as would be binding upon either of them except by Act of Parliament, and it follows that the administration of the law must remain in this difficult, uncertain, and cumbrous condition until the section in question is amended.

A further reason which makes such an amendment highly desirable is that apart from smoke which more or less nearly approximates to "black," great quantities of noxious smoke are emitted which cannot by any stretch of words be called "black," and which yet is as noisome and offensive as the densest.

Under these circumstances the Corporation of the City of Westminster, a body which has always been in the forefront of efficient administration in this matter, proposed, in a circular to the Metropolitan Borough Councils, an amendment of the section which they might all agree to advocate. The proposal was to delete the word "black" from the section altogether. On the proposal being brought to the notice of the Coal Smoke Abatement Society, it was observed that, excellent as it was to meet part of the existing difficulty, it tended to raise new difficulties in a large class of

cases where at present they do not exist. To delete the word "black" simply, and merely forbid smoke that was a nuisance, would involve the proving in every case that the smoke complained of was of such a character as to amount to a nuisance, always a difficult proceeding. It would no longer be possible to secure a conviction merely by proving the smoke was approximately black, and these are the commonest and most noxious cases. The Society therefore suggested that the words "black smoke" should be retained, and the words "or smoke" inserted immediately after them. By this amendment the section would read "black smoke or smoke in such a quantity as to be a nuisance." In this way would be retained all the summary advantage of the old wording, added to the possibility of putting a stop to smoke which, though in no sense "black," was dense enough to be a nuisance and amount to pollution of the air.

This suggestion appears to have met generally with the approval of the authorities concerned, and it is to be hoped that at the next amendment of the Public Health Act the section in question will be modified on these lines.

It by no means follows, however, that the section so amended will be in the best conceivable form. All that can be claimed for it is that it will be well abreast of English public opinion on the subject, and will go as far towards a complete suppression of the nuisance as is at present likely to be practicable. Still there are possibilities beyond what appear to be immediately practicable. Since the amendment of the section was considered, as above related, the Foreign Office at the instance of the Society has collected and issued a series of reports on smoke legislation abroad, and considerable new light is thrown on the possibilities of the question.

On the whole it would appear that, bad as we are, we stand far ahead of the majority of foreign countries. In most of these no legislation exists at all. In France, for instance, no general law has been adopted, while all the old attempts to stop smoke pollution in Paris by police "Ordonnance" failed against passive resistance. The latest one appears to have fared no better. It was of a most modest character, for it went no further than to forbid the "prolonged emission of thick black smoke," (*interdit de produire une fumée noire épaisse et prolongée*), but even this appears to be little better than a dead letter. Germany, too, has shrunk from making any general law, and does not even venture so far as France in the Paris ordonnance. The German Government goes no further than to order that "care should be taken *in all works under State control* that

the emission of *black, thick and continuous smoke* be avoided, in the first instance, by expert management of fires, proper supervision of firemen, and careful selection of fuel."

Thus we see that in these two countries the standard of atmospheric purity aimed at is considerably lower than with us under the Act as it stands.

In Dresden, however, a city which has long been noted as an example of amenity in civic management, we find that as far back as 1887 a by-law was enacted which goes beyond anything we have ventured even to propose in London, or elsewhere in the three kingdoms. It runs thus:—"In all manufacturing and industrial premises the construction of the furnaces must be of such a nature and their stoking so regulated that *no smoke containing visible particles of soot* is constantly emitted." "Where this happens only occasionally and exceptionally, the nuisance must not last longer than is absolutely unavoidable even with the most careful stoking and the employment of coal of at least medium quality."

Two years were given as a period of grace to existing premises. But the Dresden authorities were not content even with this drastic dealing with industrial premises. They extended their hand against private premises as well; and the by-law further provided that "In private dwelling houses the heating arrangement must be so contrived as to produce as little smoke as possible."

To forbid black smoke absolutely, and coloured (visible) smoke almost entirely, appears to go very far, but the step was taken not unsympathetically. At the same time an official inspector was appointed, whose duties were not only to enforce the law, but to assist citizens in complying with it. Besides reporting offending premises, he was to hear all complaints against "the practicability and onerous nature of the by-laws." He was to inquire into and suggest improvements in means for combating smoke, and he had attached to him an expert foreman stoker, who assists him in his duties and "is frequently called on to give practical illustration of the effect of skilful stoking in reducing smoke."

In these admirable and highly practical provisions we seem to get a new note in legislation which is worthy of the fullest consideration. The serious opposition to any extension of the law comes from manufacturers who plead in perfect good faith, and with convincing earnestness, that any further restrictions in smoke production are incompatible with London remaining a manufacturing city. On this point, however, there is no certainty. Many competent authorities share the belief of the German Government that by well-constructed furnaces, reasonably good fuel, and

above all, by skilful stoking, the evil would practically disappear without crippling the industries concerned. The methods they recommend are in themselves methods of ensuring economy, and were State assistance provided to explain and bring home to manufacturers how such economies could be effected, there seems no doubt that the bulk of the opposition would be removed. The hint, therefore, that we get from Dresden is that if we wish to get really efficient legislation carried through, it is highly desirable to accompany it with some provision for securing to manufacturers gratuitous instruction for stokers, and gratuitous advice on the general management of their fires. This at least appears to be the policy on which Dresden has been proceeding with so much success.

It remains to notice certain amendments suggested by American legislation. For though that country as a whole is far behind Dresden in the matter, some excellent provisions have been adopted by Philadelphia, Chicago and Massachusetts.

In Philadelphia there is an ordinance to regulate smoke from chimneys, which incorporates a colour scale for the measurement of the density and darkness of smoke; and within the limits of the city it is forbidden to emit smoke of a degree of darkness in excess of scale No. 2 for a period of more than five consecutive minutes from any locomotive or steamboat; while with regard to factories, etc., the scale of colour varies with the height of the chimney. The Chicago ordinance simply forbids the emission of "dense smoke," with a time-limit of three minutes.

Massachusetts appears to be the only State that has adopted a general Act. Section 1 of the Act of 1901 forbids as a nuisance the emission of "dark smoke or dense grey smoke for more than four minutes continuously, or for 12 per cent. of any continuous period of twelve hours."

It will be seen that the American legislature attaches importance to a time-period, that is, to having a minimum period during which the emission of objectionable smoke is permitted as unavoidable. No such period of grace has been enacted in this country, but in practice it is allowed. The length of such period differs in various places, and with various magistrates, just as does the interpretation of the word "black," and it would undoubtedly add certainty, and therefore efficient administration to the law, if we were to adopt, in amending our Act, some such time-limit as has commended itself to American experience.

ENGLISH LAW RELATING TO THE EMISSION OF SMOKE FROM CHIMNEYS.

By JOSEPH HURST.

Barrister-at-Law.

THE emission of smoke from chimneys may be dealt with under English law in the following cases:—

(1) Throughout England where that emission is a nuisance at common law;

(2) Throughout England (except London) where that emission offends against the provisions of the Public Health Act, 1875, or against similar provisions in local Acts;

(3) In London where that emission offends against the provisions of the Public Health (London) Act, 1891.

I propose to deal very shortly with (1) for, speaking generally, it will be found that readier and easier means of abatement exist under (2) or (3) than under (1).

As, however, there are sometimes occasions when considerable damage has already been caused, or when it is desired to restrain for the future a serious emission of smoke which, if allowed to continue, would be injurious to public or private health or property, I will state shortly the law relating to (1).

To constitute a nuisance *at common law* by reason of the emission of smoke there must exist (*a*) injury to health; or (*b*) injury to public or private property; or (*c*) personal discomfort to individuals.

If it be desired to protect public health, or public property, or to prevent general discomfort, the law must, in most instances, be invoked by the Attorney General, as representing the public; his action is generally (though not always) set in motion at the instance, or relation, of a public body, or of individuals.

Where, however, an individual is likely to sustain or has sustained injury to his health or property, or personal discomfort by reason of the

emission of smoke, he may himself invoke the law with respect to nuisance, by bringing an action for injunction to prevent the happening of the nuisance, or to prevent its recurrence, or to recover damages as compensation for that which has already occurred to him or his property by reason of the nuisance.

But whether the law be invoked by the Attorney General, as representing the public and its interests, or by an individual for his own protection or compensation, it will be necessary, in either case, to establish that a nuisance (as defined above) will probably be, or has been, created by the emission of smoke.

For the purpose of so doing it is not necessary to make out that black smoke (as under the Public Health Acts referred to above) or smoke of any shade, density, or quality, is likely to be, or has been, issued. It will be enough to establish that a nuisance (as defined above) is likely to occur, or has occurred, from the issue of smoke or vapour, or smells from a factory or other chimney, whether the latter be the chimney of a private dwelling house or not.

But what may be an actionable nuisance, even in this sense, is not capable of precise definition, applicable to all circumstances, or to all localities. This may be learned by a perusal of the Judgment of the late Lord Chief Baron Pollock, in the case of *Bamford* v. *Turnley* (31 L. J Q. B., 292) where with the precision and freshness of language which always distinguished him, he said :—

"The question so entirely depends on the surrounding circumstances —the place where—the time when—the alleged nuisance, what—the mode of committing it, how—and the duration of it, whether temporary or permanent, occasional or continual—as to make it impossible to lay down any rule of law applicable to every case, and which will be also useful in assisting a jury to come to a satisfactory conclusion. It must at all times be a question of fact with reference to all the circumstances of the case. Most certainly, in my judgment, it cannot be laid down as a legal proposition, or doctrine, that anything which, under any circumstances, lessens the comfort or endangers the health or safety of a neighbour, must *necessarily* be an objectionable nuisance. That may be a nuisance in Grosvenor Square which would be none in Smithfield Market. That may be a nuisance at mid-day which would not be a nuisance at midnight. That may be a nuisance which is permanent and continual, which would be no nuisance if temporary or occasional only. A clock striking the hour, or a bell ringing for some domestic purpose may be a nuisance if unreasonably loud and discordant, of which the jury alone must judge ; but although not unreasonably loud, if the owner, from some whim or caprice, made the clock strike the hour every ten minutes, or the bell ring continually, I think a jury would be justified in considering it to be a very great nuisance. In general a kitchen chimney, suitable to the establishment to which it

belonged, could not be deemed a nuisance, but if built in an inconvenient place or manner, on purpose to annoy the neighbours, it might very properly be treated as one."

To this example I would venture to add that of a kitchen chimney improperly used with reference to fuel consumed, or otherwise, whereby large quantities of smoke were emitted for long intervals of time. He proceeds—

> "The compromises that belong to social life, and upon which the peace and comfort of it mainly depend, will furnish an indefinite number of examples in which some apparent natural right is invaded, or some enjoyment abridged, to provide for the more general convenience or necessities of the whole community."

The above views were expressed in an action successfully brought in respect of nuisance arising from brick burning.

Smoke, unaccompanied by noise or by noxious vapour, noise alone, and offensive odours alone, although not injurious to health, may severally constitute a nuisance. The material question in all cases is, whether the annoyance produced is such as materially to interfere with the ordinary comfort of human existence. Hence an injunction was granted to restrain the issuing of smoke and effluvia from a factory chimney, and the making of noise in the factory, although it was situated in a manufacturing town, it being proved that such smoke, effluvia and noise were a material addition to previously existing nuisances. (Crump *v.* Lambert, L.R. 3 Eq. 409; affirmed on appeal, 17 *Law Times* N.S. 133.)

Public Health Act, 1875.

From attempts to define what is an actionable nuisance, and from discussions of what is the appropriate proceeding when a common law nuisance is threatened or exists, it is encouraging to those who are earnest in the promotion of public health to turn to the plain language of the smoke sections of the Public Health Acts, referred to above, under which health and property are generally (although, I fear, with many exceptions) effectively protected.

The Public Health Act, 1875, contains the statutory law as to the emission of smoke throughout England, except in London, and except in a few provincial cities and towns governed by local Acts.

Public Health (London) Act, 1891.

The provisions of this Act relating to smoke nuisance are practically (with some extensions) the same as those in the Act of 1875, already set out at some length. But since the Act of 1875 does not (with some

slight exceptions) apply to London, the smoke sections have been included in the Act of 1891, so as to be applicable to the Metropolis within "the administrative County of London."

The sanitary authorities within the London area are the Corporation of London and the city and borough councils.

In practice it is found in case of neglect of duty by the sanitary authority (excepting the Corporation of London) that a representation to the London County Council secures the abatement of a nuisance, or, at any rate, due attention to the matter.

It will be observed that up to the present time no legislation has been attempted with the view of minimising smoke from domestic kitcheners or grates. The height of buildings, etc., affecting the access of light and air have been the subject of drastic enactments; but the domestic kitchener or grate, which by the smoke it sends forth enormously affects light and air, has, so far as legislation is concerned, been left to work "its own sweet will." This seems inconsistent with the principle which one would assume underlies legislation, under which domestic appliances in connection with water, gas, electric current, etc., have been the subject of jealous regard, and are the objects of frequent domiciliary visits even in the neighbourhood of the domestic hearth. It is to be hoped that as a result of the inquiries now being carried on by the Coal Smoke Abatement Society, with the assistance of the Office of Works and others, a domestic grate may be discovered which shall, by improved combustion, prevent, at least, black smoke. When such a grate is discovered, legislation will be not only desirable but opportune, by which there may be secured to the consumer more beneficial use of fuel, and to the Metropolis and to large provincial cities and towns brighter and cleaner atmospheres.

REPORT UPON RETURNS FURNISHED BY LOCAL AUTHORITIES WITH REGARD TO THE CARRYING OUT OF THEIR

POWERS & DUTIES IN THE MATTER OF SMOKE ABATEMENT.

By LAWRENCE W. CHUBB, F.C.I.S.,

Secretary, Coal Smoke Abatement Society.

WITH the object of ascertaining to what extent local authorities have grappled with the problem of smoke abatement, all corporations and urban district councils in the United Kingdom have been asked to furnish replies to a series of questions addressed to them on behalf of The Royal Sanitary Institute and the Coal Smoke Abatement Society.

In all, 205 authorities have complied with the request, and from the answers supplied a considerable amount of interesting information may be extracted. While it is true that a feeling of indifference or hopelessness is manifested by a minority of the sanitary authorities, on the whole the reports show that where a local authority resolutely faces the subject of smoke abatement, with a determination to enforce the provisions of the Public Health Acts, it does not often experience insuperable difficulties in minimising, if not in entirely suppressing, black smoke nuisances. At the same time there is a general consensus of opinion that the law should be materially simplified and strengthened.

Indifference of certain Local Authorities.

Of the 205 reports, those received from county councils do not call for special comment, as such councils do not possess urban sanitary powers. Thirty other reports may be summarily dismissed, for the authorities confess that they have either entirely neglected the matter, or that the smoke evil has not been sufficiently acute in their area to demand attention. It is

fair, perhaps, to infer that the many authorities from whom no returns have been received should be placed in the same category. The authorities whose reports may be dismissed as being negative in character are those for the following places: Abertillery, Carnarvon, Colchester, Crewe, Darlington, Devonport, Doncaster, Dover, Dunfermline, Exeter, Harwich, Hereford, Ilford, Ilkeston, Kesteven C.C., Leamington Spa, Llanelly, Maidstone, Oldbury, Reigate, Rochester, St. Albans, Shrewsbury, South Shields, Tipton, Wednesbury, West Bromwich, Wokington, and Woodford.

The inactivity on the part of some of the councils named is evidently due to a fundamental misconception of the subject. The excuse given on behalf of Tipton may be cited as a typical illustration of this assumption. It is said on their behalf that the "council will not take any steps in the matter as they are too glad to have the smoke as an evidence of renewed trade." If every sanitary authority could be brought to recognise that the emission of black smoke is an ocular proof of an avoidable waste of fuel which, as has been abundantly demonstrated, can be remedied to the pecuniary advantage of the employer, as well as to the comfort of the public, they might, perhaps, realise the desirability, from all points of view, of performing their statutory duties in the matter.

It is refreshing to turn from the councils which have displayed no interest in the subject to those which manifest a keen sense of their obligations to the public.

LOCAL AUTHORITIES HAVING SPECIAL SMOKE INSPECTORS.

The following authorities state that they employ special inspectors with the object of dealing with smoke nuisances:—Bethnal Green, Birmingham (4 each), Bradford, Croydon, Edinburgh, Glasgow (2 each), Hackney, Hammersmith, Hull, King's Lynn, Lambeth, Leeds, Liverpool (3 each), City of London, London County Council (5 each), Manchester (5, one being a chemist in whose duties is included the inspection of chemical and other works where chemical or expert knowledge is required), Marylebone, Paddington, Stockport, Salford, Sheffield, and West Ham also have special smoke inspectors.

In other cases the sanitary officers or inspectors of nuisances are instructed to deal with nuisances arising from the emission of black smoke.

POLICE ASSISTANCE.

The services of the police are utilised by the following authorities:— Alfreton, Ayr, Battersea (occasionally), Bury (where a policeman accompanies an inspector making observations), Cambridge, Devonport, Dun-

fermline, Edinburgh, Gloucester, Gorton, Greenwich (occasionally), City of London (when required), Manchester (casually), Margate, Merthyr Tydfil, Nottingham (police only), Paddington, Paisley (police only), Ramsgate (police only), and Southport (police only).

In the case of Nottingham the co-operation of the police has evidently been of much service, for the corporation recommend an alteration of the law, so that it shall be a special duty of the police to take proceedings in all cases of emission of black smoke.

Time Limits for the Emission of Smoke.

One of the questions addressed to local authorities was:—"Has any hourly or other limit been fixed during which black smoke may be emitted from factories or other works within the area controlled by the corporation?" The Public Health Acts do not define what constitutes a black smoke nuisance. They simply indicate that, where black smoke is emitted in such quantities as to be a nuisance, the nuisance shall be liable to be dealt with summarily under the Acts. It is open to doubt whether any imposition of a time-limit during which black smoke might be emitted with impunity, would be desirable. Nevertheless, it must be admitted that the present state of the law has led to a great deal of confusion, for each authority itself defines what, in its opinion, constitutes a black smoke nuisance, and glaring anomalies naturally exist. For instance, at Leeds the emission of black smoke for an aggregate period of three minutes in an hour is held to be sufficient to justify action, whereas at Middlesborough the period is fixed at fifteen minutes, and at Perth the emission must be *continuous* for eight minutes.

Several authorities have expressed an opinion that the fixing of a time-limit would be both illegal and unwise, but on the other hand a large number point out that it would be far less difficult to obtain a conviction were a fixed time-limit imposed than is the case at the present time, when Magistrates have their own views as to what constitutes a black smoke nuisance.

Increase or Decrease of Smoke.

145 Councils have answered the question "In the opinion of the authority is the emission of black smoke increasing or decreasing within its area?" 25 have replied that an increase has taken place; 80 have stated that in their judgment the evil shows a tendency to decrease, often due to the substitution of gas for steam power; while 40 stated that the nuisance remains stationary.

ACTION TAKEN BY LOCAL AUTHORITIES.

Councils were asked to state how many smoke nuisances were reported to them during each of the last two years, how many statutory notices were served by them, and the number of prosecutions undertaken. The information supplied on these points is too inadequate to permit of detailed and satisfactory analysis.

The incomplete returns furnished by 23 Metropolitan Borough Councils show that 4,353 reports of smoke nuisances were dealt with during the last two years, 897 statutory and 394 intimation notices being served and 61 prosecutions undertaken.

The returns furnished by 109 provincial authorities are also incomplete. So far as they may be relied upon, however, they show that during the last two years 9,553 smoke nuisances have been reported to the 109 councils; these have led to the issue of 4,059 intimation and statutory notices and to 2,345 prosecutions.

The information with regard to prosecutions undertaken by provincial authorities is misleading, for seven of the authorities are responsible for no fewer than 2,181 of the proceedings, leaving only 164 prosecutions undertaken in two years by the remaining 102 authorities. The city of Liverpool, which moves under a special local Act and not under the Public Health Act, 1875, undertook 643 prosecutions in 1903 and 615 in 1904, being successful in 633 and 602 cases respectively and receiving in fines £2,466 12s. 2d., an average of about £2 per case. Of the other authorities, Manchester initiated 277 cases, Glasgow 226, Birmingham 178, Bradford 111, Nottingham 69 and Sheffield 62.

One of the most disquieting features manifested by the information supplied under this head is the small percentage of cases in which statutory notices have been served and subsequent proceedings initiated by local authorities. In the provinces, after deducting the cases dealt with by the 7 authorities referred to in the preceding paragraph, there still remain 6,182 reports of black smoke nuisances. In 2,087 instances letters of caution or statutory notices have been served, and apparently the letters of caution far exceed the statutory notices in number. Only 164 prosecutions were undertaken. In the Metropolis only 897 statutory and 394 intimation notices were issued in respect of 4,355 cases and the prosecutions amounted to 61. It is obvious that if local authorities do not follow up reports of smoke nuisances by serving statutory notices and initiating legal proceedings the nuisances are not likely to be abated. Several councils state, in extenuation of their inaction, that it is hopeless to secure

a conviction as the members of the Bench adjudicating are themselves often offenders in the matter of smoke nuisances!

Smoke Nuisances in adjoining Districts.

A considerable number of local authorities complain of black smoke nuisances arising in the area of adjoining authorities, but the only councils which appear to have moved in such cases, either by written complaints, by serving statutory notices, or by initiating proceedings, are Batley, Brighton, Ealing, Enfield, Hammersmith, Huddersfield, Kensington, Lancaster, the City of London, Manchester, Salford, Shoreditch, Stretford, Stroud, Swinton and Pendlebury, and Westminster.

Methods of Identification of Black Smoke.

In order to ascertain the means adopted for the identification of black smoke, local authorities were asked: "Is any standard or scale used to identify the density of smoke? If not, what method of scheduling or identification is adopted?" The replies disclose that the general rule is to permit the inspectors taking observations to act upon their own judgment. Most of the important corporations provide their officers with special sheets on which to record, in graduated columns, the density of smoke emitted, and in some cases observations are made jointly by two inspectors. The following authorities treat as black all smoke which cannot be seen through when it emerges from the chimney: Ashton-under-Lyne, Blackburn, Bury, Chorley, Epsom, Farnworth, Halifax, Heywood, Oldham, Preston, Rochdale, St. Helens, Southampton and Stretford. Eccles, Liverpool and Newcastle-on-Tyne consider smoke black when it is opaque after it has travelled a few yards; Huddersfield and Norwich when the lightning conductors cannot be seen through it; and Falkirk when the top of the chimney cannot be seen through it. Several authorities supply their officers with sheets illustrating various shades of smoke. Among these, Coventry, St. Marylebone and Willesden use the diagrams issued by the Coal Smoke Abatement Society; Cardiff Hammersmith, Reading and Woolwich use Ringlemann's Smoke Scale, and Bournemouth has adopted the method of identification advocated by Messrs. Sanderson & Clayton. St. Pancras, Battersea, Manchester, the City of London, the London County Council, and the London Port Sanitary Authority have specially prepared and shaded diagrams for the use of their inspectors; and Westminster uses the scale adopted by St. Pancras. Photography is employed, as an accessory to the inspector's

personal observation, by Bradford, Holborn and Hull; and the Glasgow Corporation state: "The term 'black smoke' is defined as smoke containing 281 lbs. of solid matter per million cubic feet discharged, light brown smoke containing only 20 lbs. of solid constituents."

PROPOSED AMENDMENTS OF LAW.

Local authorities were further asked whether, in their opinion, any amendments were needed in the law with regard to the suppression of black smoke nuisances. Fifty-six have expressed no opinion upon the desirability of any change being effected in the law with regard to the abatement of smoke, and only two have indicated their satisfaction with the law as it at present stands. On the other hand this question elicited a number of helpful suggestions, of which the following are perhaps the most useful.

The proposed amendments mainly deal with Clause 91 of the Public Health Act, 1875, the clause which declares a chimney (not being a chimney of a private dwelling house) emitting "black" smoke, to be a nuisance within the meaning of the Act. Owing to the difficulty of obtaining the requisite technical evidence to secure a conviction under the alternative provision of the Act designed to prohibit the use in trade premises of a furnace so constructed as not to consume its own smoke, practically all prosecutions issued by local authorities with the object of securing the suppression of smoke nuisances are taken under the section prohibiting the emission of black smoke.

The following local authorities advocate the omission of the qualifying word "black" from the section, in order to enable proceedings to be instituted in cases where smoke emitted is actually a nuisance though not "black" in colour: Blackpool, Cardiff, Chelsea, Epsom, Lambeth, and Sheffield. The authorities advocating the substitution of the word "dense" for "black," are Keighley, Nelson (or delete "black"), and Stretford (and delete words "as far as practicable").

The Coal Smoke Abatement Society has at various times carefully considered the desirability of amending Section 91 of the Public Health Act, and has come to the conclusion that it would be inadvisable to delete the word "black," as proof of the sustained emission of black smoke is (or should be) at present sufficient to secure a conviction; it has also felt that the substitution of the word "dense" for "black" would only remove one technical difficulty to create another. It, however, has suggested that the section would be materially strengthened if it were broadened to permit of prosecutions in respect of smoke of any colour

emitted in such quantities as to be a nuisance. All that is needed to secure this desirable amendment is the insertion in Section 91 of the Public Health Act, 1875, and in Section 24 (*b*) of the Public Health (London) Act, 1893, after the words "black smoke," of the words "or other smoke." It is interesting to note that this proposal is also made on behalf of Cardiff, Enfield, Greenwich, Hammersmith, Kensington, the London County Council, Paddington, Westminster, and Wood Green. Liverpool suggests the substitution of the words "excessive and unnecessary" for "black."

As has been already indicated, several authorities allude to the difficulty they experience in obtaining a conviction owing to the fact that the Magistrates before whom the proceedings take place are themselves black smoke offenders. They therefore press for the appointment of Stipendiary Magistrates, who might be relied upon to have no personal bias on the question.

The lowness of the penalties imposed upon the conviction of offenders is frequently commented upon, and several authorities urge that the penalties should be materially increased for the first offence and automatically raised on subsequent conviction, in order to make it imperative on the part of the manufacturers to abate smoke nuisances. It is pointed out that where penalties are not sufficiently large to act as a deterrent, offenders prefer to run the risk of further convictions rather than adopt means to abate the emission of smoke. It is also suggested that magistrates should inflict a penalty when an abatement order is issued. On this point the Public Control Committee of the London County Council has recommended the alteration of the law, by the imposition of a direct penalty of not exceeding £10 for the first offence, increasing for subsequent offences, instead of applying to smoke nuisance, as at present, the complicated procedure that may be properly applicable to a sanitary nuisance. Bolton, Bootle, Bradford, Northampton, Salford and Willesden are amongst the other authorities which urge that increased penalties should be provided for.

It is further suggested that Parliament should be invited to fix a definite hourly time-limit for the emission of black smoke, proof of the limit having been exceeded to be sufficient to secure a conviction. The local authorities urging this amendment are those for Dundee, Keighley (four minutes per hour suggested), Kidderminster, Lancaster, Luton (fifteen minutes per hour suggested), Stroud, Tottenham, and Wood Green.

Another interesting proposal is that put forward by the Chelsea Borough Council, on whose behalf it is pointed out that a great deal of

offensive black smoke is emitted from the chimneys of the large mansions and flats in the district. It is suggested that the law should be amended to enable such nuisances to be dealt with.

Other suggestions are that the delay arising from the present complicated procedure, which involves the service of statutory notices, should be obviated by the giving of power to the Medical Officer of Health to summon forthwith on the detection of a nuisance; that the police should be empowered to initiate proceedings; that a definite scale or standard should be provided for the identification of smoke; that firemen should be dealt with and fined when proper appliances and proper coal are found (this is done under a local Act at Nottingham); that factory inspectors should be appointed by a Government department; that the prohibition against the emission of black smoke should be applied to property in possession of the Crown, a proposal adopted at a Conference of Metropolitan Borough Councils, and endorsed by the London County Council; and that provision should be made for the infliction of heavier penalties in cases of black smoke emitted from locomotives on highways or railways.

CONCLUSION.

To sum up, the returns disclose that while the black smoke evil is very generally felt and deplored, relatively few local authorities have in the past taken a decided stand in the matter, and that while this inactivity may sometimes be traced to apathy, it is more often due not to any inclination to evade responsibility, but to a feeling of hopelessness in view of the uncertainty of obtaining convictions. Where authorities have taken a decided stand, however, even with the imperfect machinery at present available for the suppression of smoke nuisances, it is only fair to say that they claim to have diminished the evil. Little improvement or zeal can be looked for until the law is simplified and extended, and a more summary and effective method of procedure provided. It is, perhaps, not too much to hope that the Local Government Board, in view of the suggestions made by important corporations, may see its way to clothe local authorities, in the immediate future, with the further powers for which they ask.

SMOKE ABATEMENT FROM THE SANITARY INSPECTOR'S POINT OF VIEW.

By T. G. DEE,

Sanitary Inspector, City of Westminster.

(ASSOCIATE.)

THIS paper gives an inspector's point of view of the subject of smoke abatement.

The Public Health (London) Act, 1891, repealed "An Act to Abate Nuisances arising from the Smoke of Furnaces in the Metropolis and from Steam Vessels above London Bridge" (16 and 17 Vict., chap. 128), and thus fixed on sanitary inspectors in the metropolis the duty of reporting, to their several local authorities, nuisances arising from the emission of smoke, which had previously been the joint duty of the police and sanitary officers, and was almost entirely left to the police to carry out. On examining the provisions of the law we found that we had no power over the chimneys of private dwelling houses. We were of the opinion that *any* other chimney sending forth *black* smoke was a reasonably easy matter to deal with, but that the procedure under the section was very slow, and that the maximum penalty (ten pounds), section 4, sub-section 4, not being cumulative, was inadequate to prevent nuisances occurring thereunder. That either magistrates or local authorities were unwilling to close works (note Doulton's) or to deal with them as recurring nuisances (note Holborn and St. Martin's-in-the-Fields). Under these circumstances a study of the construction of furnaces, and the more or less complete combustion of coal, was forced upon us, so that our evidence might be of value when attempting to apply the stronger provisions of the Act, which required furnaces to be constructed so as to consume or burn the smoke arising from such furnace, the colour of the smoke being immaterial and the penalties cumulative. We then found that during the latter part of the eighteenth and the first half of

the nineteenth centuries, engineers of eminence had introduced and patented many and diverse appliances attempting to solve the problem of full oxidisation of furnace fuel. For example, patents were granted for:

"Admitting air through openings or over the furnace door," to James Watt, 1785; Robertson, 1800; and Billingsley, 1842.

"Gradually coking the coal," James Watt, 1785; Robertson, 1800; Drew, 1837; Jukes, 1838; and Blackwell, 1848.

"Letting air in at the bridge or by hollow furnace bars," W. Thompson, 1796: Mons. de Promy, 1810; Wm. Sheffield, Wakefield, and Johnson, all three in 1812; Parkes, 1820; Chapman, 1824; Coad, 1835; S. Hall, 1836; C. W. Williams, 1839; Kurby, 1840; Prosser, 1842; Butler, 1845; Whiteley, 1845; Robertson, 1848; Johnson, 1849; and in 1854, Woodcock, Parkes, and Galloway.

"Rocking Bars," Oldham, 1825; Miller, 1839; Newcome, 1849; Hall, 1849; Galloway, 1849; Hargreaves, 1850.

"Mechanical Stokers, supplying coal through hoppers," Robertson, 1800; Brunton and Gregson, both 1816; Chapman and Stanleys, both 1824; Whitless, 1845; Acocks, 1848; Sherba, 1852.

"Side firing, alternately," Tosh, 1815; Rodda, 1838; T. Hall, 1837; Green, 1853.

"To automatically and gradually close furnace doors," Pritchard, 1820; Prideaux, 1850.

"Injection of jets of steam," Chappe, 1836; Trison and Bull, 1838.

"A second fire to burn smoke formed," Collier in 1843.

"Upward firing," Godwin and Foard in 1841.

"Inclined bars," Baron von Rather, 1840; and Hendruch, 1841.

"Washing smoke to deposit the carbon," C. W. Ward, 1792; Jeffries, 1824; Hedleys, 1834.

Obviously a longer period of study was necessary than could be reasonably expected of sanitary inspectors, who had much to do besides looking after smoke. In the witness box, under cross examination, the weakness of our knowledge of a special method of combustion was frequently shown up, in strong contradiction to the *expert* who was *certain* that the smoke the inspector had seen could not be sent forth from the furnace *he* had constructed, as the admission of air was perfect; or that the mechanical stokers could not supply the coal so badly. One or the other mechanism was absolutely infallible, and he (the expert) was also certain that the particular furnace *was* constructed so as to burn, *as far as possible*, all the smoke arising from such furnace. Under such circumstances is it to be wondered that the magistrates are loth to inflict the

cumulative penalty? Is it not most probable, that, after duly discounting the expert's evidence, he who has spent the whole of his life in the study and prevention of smoke nuisances knows more about the "*as far as practicable*" than the sanitary inspector does? Thus, rarely is a fine of more than £10 obtained for any one offence, and then, if obtained, only after adjournments to again take observations. During this period great care is exercised and no smoke sent forth. Under these circumstances the very usual practice now is to proceed under the easier clause which makes it an offence to send forth black smoke, from certain chimneys, in such quantity as to be a nuisance, as no evidence of construction of furnaces or to as far as possible consume the smoke is admissible here.

So the sanitary inspector has to deal with a nuisance either from his own observation as a statutory officer, or as the result of his observation upon the complaint of some other person. His power is here confined to black smoke; on the emission of grey, blue, brown, yellow, or white smoke, in whatever quantity, he has nothing to report.

Then, what is the quantity of black smoke emitted which constitutes such a nuisance? Surely the quantity emitted must depend upon two factors: the density of the black smoke, and the length of the emissions. Obviously an emission of smoke, black and as dense as it is possible to conceive, for a period of, say one minute, can be equalled in quantity by a black smoke, which appears against the clear sky to be grey, if the latter be continuously emitted for, say half an hour.

A conviction is naturally most easily obtained when the inspector swears that the smoke on the occasion referred to was *dense black* smoke, and under such circumstances short emissions of three minutes are much more useful in obtaining convictions than a less dense smoke for a much longer period.

On the other hand those who have studied this question, or who have carefully followed the course of this Conference, cannot fail to note that the aim is very largely to abate the ill-effects of the discharge of the many slighter emissions, which in the aggregate are so enormous, and affect our climate so greatly. For example, this side is enforced by the Coal Smoke Abatement Society, and affects sanitary inspectors in two ways.

Firstly it is used as a defence by smoke producers, in large chimneys, when those chimneys appertain to furnaces used to heat buildings and cook the food consumed therein. In such cases they try to prove that notwithstanding the fact that some smoke is emitted from their chimney, yet it is much less than the aggregate amount would be when sent forth

from the number of chimneys necessary if each flat therein had its own kitchen and other chimneys. Then again, strong representations of the emission of black smoke for long periods, which is certainly not dense, are forwarded to the local authority to deal with.

But whilst the definition of what is a nuisance as to black smoke is left with an inspector, shall he refuse to use his own judgment and accept that of the smoke producer? It would be as unwise to do the latter as to accept the judgment of the most earnest exponent of smoke abatement here, who, in reaching after his ideal, aims so high that there is a danger of unconscious bias, and a tendency to re-enact the law under which one John —— was, in 1306, tried, condemned and executed for burning coal in the City of London.

SMOKE NUISANCE INSPECTORS AND THEIR DIFFICULTIES.

By WM. NICHOLSON.

Smoke Inspector, Sheffield.

THE smoke nuisance and its abatement is one of the most important of public health questions.

It is a national nuisance. The pollution of the atmosphere which affects everybody does incalculable harm to public health and property and all classes ought to assist in its abatement.

To satisfactorily solve the question it is absolutely necessary to proceed in practical lines to prevent injury to trade.

Smoke.—All smoke is a nuisance when in contact with persons or property, for it produces dirt and damage.

Necessary Nuisance.—The smoke which it is impracticable to prevent in boiler, furnace, and fireplace is a necessary nuisance.

Statutory Nuisance.—Smoke which can be practically prevented is a statutory nuisance. Experts differ as to the number of minutes in a given period which constitute a nuisance. Some authorities say two minutes of black smoke from a furnace in one hour is a statutory nuisance others three, four, five, six, and as much as fifteen.

Board of Experts.—To ascertain what is and what is not a statutory nuisance it is imperative to have a *Board of Experts.* They would test smoke preventing appliances and processes suitable for boilers, furnaces and fireplaces, and find out what smoke was necessary under various conditions of working.

The necessary smoke would be the uniform standard allowed, and above the said amount would be a nuisance within the meaning of all good smoke law. The standards arrived at would be adopted by local authorities, and remain in force until it was found practicable to reduce them.

The work of such a suggested Board would be of great value to public health, manufacturers, and owners of appliances.

Cost.—In 1902 the German Government granted £4,000, the money

to be used in giving courses of instruction and practical lessons to firemen and engineers, with the object of procuring smoke abatement.

If Governments will not provide money for this necessary work to be done, then manufacturers and owners of appliances ought to.

[*This Discussion applies to the subject before the Conference on Friday morning—"Administration, Legislation, and Necessary Reforms."*]

Mr. Arthur J. Martin (London) said that, from the Report presented that morning by the Secretary to the Coal Smoke Abatement Society, it would seem that the absence of progress at the present time was due, not so much to lack of the necessary powers as to the neglect of local authorities to exercise the powers which they already possessed. Dr. Butler had given them on the previous day a striking example of what could be accomplished under the existing law, if the local authority chose to enforce it. However, whether they wished it or not, legislation was bound to take place. It might not take the form of measures introduced by the Government, or by associations like the Coal Smoke Abatement Society; but they would get it by a sidewind in the shape of clauses to bills promoted by companies or municipal corporations. These clauses might, on the one hand, invest the promoters with powers or monopolies which it was not to the public interest to confer upon them, or, on the other, might impose restrictions put forward by opposing parties with the express object of hampering the enterprise and reducing its utility to the public. Such clauses were apt to crystallise into precedents. In dealing with such highly technical matters Parliament ought not to have to depend for guidance to such an extent as it now did upon the interested statements of the promoters and their opponents. The industries of the country were becoming more and more dependent upon applied science; and it was high time that the Government should have at its back an expert scientific body to watch the interests of the country as affected by proposed legislation bearing on technical matters.

Mr. Fred Cleeves (London) said that before the British public would submit to any law, it must be convinced that that law was just, fair, and reasonable. As the officials of these societies told them, there was enough passive resistance to the laws already on our Statute Book. Of course, a man had no more right to poison another man with coal smoke than he had with arsenic fumes, but up to the present the public have accepted the first as inevitable. Some people actually believed that it was beneficial. Our first and most pressing duty, therefore, was to educate the public; then any necessary legislation will follow as a matter of course. They had heard of the smoke prevention laws in New York and Berlin. He had been in New York, and in his opinion, if it were not for those laws, New York would be uninhabitable. They

burn solely anthracite coal in New York. He also knew Berlin pretty well. In his opinion it was the cleanest capital in Europe. Some years ago, the police of Potsdam told the proprietor of a factory there, one that had existed for many generations, that he must stop making smoke. The proprietor pleaded the excuse that they were so familiar with here, that he had tried every means to abate the smoke, etc. "No, you haven't," said the police, "you should use anthracite coal, then you cannot make smoke." They gave him a month wherein to change his fuel or stop his works. He repeated his belief that education must precede legislation, and was sure that when the British manufacturers and householders were convinced that they could save money by not making smoke, they would cease to make it.

Councillor W. Muirhead, J.P. (Liverpool) said that he wished to controvert the statement made by Baillie Anderson (of Glasgow) that Glasgow was the first municipality to move in the matter of smoke abatement. Liverpool was very many years ahead of the rest of the country, even of the Scotch Acts of 1857, because Liverpool moved in this matter in 1854. It was very necessary the word *black* should be omitted, and the wording of the Liverpool Act should be substituted: that such cases as came under the ken of the smoke inspectors and sanitary staff were as a rule tried by the *Stipendiary*, an example that all large municipalities might follow; and he would suggest the framing of a universal Act for Great Britain and Ireland, on the lines of the Liverpool Local Act.

Dr. Ormandy (Warrington) expressed the hope that the Congress would not terminate without some practical step being taken. On that day a plea had been raised by several speakers for the consolidation of the laws relating to smoke emission. The speaker thought that an almost more important step at the present moment was the consolidation of the smoke abatement societies of the country. It had been stated that the London Society were so hampered for want of funds that little could be done. He thought that this was largely owing to ignorance among the public as to the value of the work that was being done. He proposed that the London Society should be the head of a British Smoke Abatement Society and an arrangement might be made that all the provincial societies paid an affiliation fee to the central society, much on the lines upon which the Automobile Club of Great Britain and Ireland is run at the present time. With such a central society it would be possible to lay before the Government measures which had a wide-spread and powerful support. It was only through such a central society that the investigations proposed in Sir John Primrose's paper could be carried out. Many speakers had referred to the splendid work carried out by the inspectors under the Alkali Act. He thought that one duty of such a central society would be to ask Government to widen the scope of the Alkali Act so as to include the smoke nuisance,

thereby removing the present anomalous condition of affairs existing whereby men appointed by local authorities are placed in the position of smoke inspectors with absolutely no security of tenure. Manufacturers would act upon the report of properly trained and fully authorised Government inspectors, but refuse to do so under the present circumstances, and the law itself was rendered practically valueless by the fact that the inspectors as appointed at present were afraid of acting.

DR. SIDNEY DAVIES (Woolwich) referred to the fact that proceedings in London for smoke nuisance were usually taken under Sec. 24 of the Public Health (London) Act, 1891, under which it was necessary to serve notice before taking out a summons. In Woolwich, however, it had been found that the best way was to proceed under Sec. 23, (2), (b), which made it penal to negligently use any furnace so that the smoke was not effectually consumed. When the sanitary inspector observed any smoke nuisances, he at once entered the works and took note as to the mode of stoking, and the nature of the fuel, and was then able to give evidence that there had been some neglect in one of these respects. Previous speakers had stated that domestic smoke had the greater share in obscuring London air, and had quoted the large amount emitted on Sunday when the Sunday dinners were being cooked. Dr. Davies considered that this might be true for the West End, but it certainly was not the case in the East End of London. From mid-day Saturday to Monday morning the Houses of Parliament could usually be seen from Shooters' Hill, when it was daylight, but rarely were they visible during the rest of the week. This showed that in the East, at any rate, factories were the chief source of London smoke. There were some factories, however, which were exempted from the Public Health Acts. The Arsenal was the principal source of smoke nuisance in Woolwich, and no redress could be obtained. No doubt the Arsenal officials honestly believed they were doing their best to diminish smoke, and had appointed inspectors to watch the chimneys, but the extraordinary thing was that the inspectors could not see the smoke. Dr. Davies endorsed what Mr. Chubb had said with respect to the Arsenal, and hoped that it would go out from that Conference, and reach the ears of His Majesty's newly appointed Government, that the Government factories were the creators of perhaps the greatest smoke nuisance in the whole of London, and consequently guilty of wasting a large amount of public money.

CREMATION.

By C. KILLICK MILLARD, M.D., D.Sc.,
Medical Officer of Health for Leicester, and Medical Referee to the Leicester Cremation Authority.

(MEMBER.)

Read at Sessional Meeting, Leicester, March 24th, 1906.

CREMATION, or the practice of disposing of the human body by fire, like many other new things, is in reality very old. It was largely, indeed generally, practised by the ancients, and in Greece the right to be burnt was only denied to suicides, young infants, and persons struck by lightning. In the modern trend towards cremation, therefore, we have another instance of history repeating itself.

Some people prefer not to face this question because they are over-concerned about the fate of the body after death, and fear to suggest any alternative to old-established and familiar custom. Others, again, do not face it because they feel so little concern and do not care what happens to the body. Neither of these extremes, it seems to me, is right. It is true that the body after death is but the empty shell, the worn-out and discarded casket, from which the spirit, the living and immortal soul, has fled. Of course, nothing that happens to this empty shell can really affect us. Nevertheless, the body is sacred in death as well as in life, and it is surely our duty to provide for its reverent disposal by the method which, in the light of modern science, and with due consideration to the interests of the living, appears to us to be the best.

The task of those who would advocate the cause of cremation is very different to-day from what it was thirty years ago, when the late Sir Henry Thompson and other pioneers first essayed it. At that time the difficulties and obstacles must indeed have seemed overwhelming. Inhumation had been the universal practice (in Europe) for centuries, whilst cremation was unknown. The subject was surrounded by prejudice, superstition and sentiment. The possibility of any alternative method to inhumation had not been contemplated, and the prospect of being "laid to rest" in the

earth after death had become inborn in men's minds. The suggestion of burning the body must have come to many people not only as a novel but even as a shocking idea. All sorts of objections were raised against it. It was not believed that it could be carried out without nuisance: it was urged that it would encourage the committing of crime; and it was described as heathenish, revolting, and opposed to Christian teaching.

One by one, however, the difficulties and objections have been almost all overcome, until, at the present day, cremation takes its place as one of the recognised and legalised methods of disposing of the dead, sanctioned alike by Church and State. (The Church of Rome still declines to sanction it.)

The Cremation Society of England was formed in 1874, with Sir H. Thompson as President. Its members subscribed to the following declaration:—"We disapprove the present custom of burying the dead, and claim to substitute some mode which shall rapidly resolve the body into its component elements by a process which cannot offend the living, and shall render the remains absolutely innocuous. Until some better method is devised, we desire to adopt that known as Cremation."

It is undoubtedly due to the enthusiasm and dogged perseverance of this society during the thirty-two years it has been in existence, that the change in public opinion has chiefly been brought about.

It was in 1879 that the first crematorium in this country was erected at Woking. Owing to the opposition of the Government, however, it was not used until after Mr. Justice Stephen, in 1884, delivered his famous judgment declaring that cremation was a legal procedure, provided that no nuisance was caused to others. The use of the Woking crematorium was then begun and has continued ever since. At first the number of cremations performed annually was only small, but it has steadily increased, and the total now amounts to nearly 3,000. Moreover, the "quality" of the cremations is even more striking than the quantity, for they have been drawn almost entirely from the educated and thinking classes, and include very many names highly distinguished in art, literature, science and politics, as well as many of titular rank.

For several years the crematorium at Woking was the only one in the country. In 1892, however, a second crematorium was opened at Manchester, and this has been quickly followed by many others in various parts of the country until at the present time there are no less than thirteen.

The following list gives the names and dates of opening of the various British crematoria.

List of British Crematoria:

The Woking Crematorium...	First used in 1885
The Manchester Crematorium	Opened in 1892
The Glasgow Crematorium...	„ 1895
The Liverpool Crematorium	„ 1896
The Hull Municipal Crematorium... ...	„ 1901
The Darlington Crematorium	„ 1901
The Leicester Corporation Crematorium ...	„ 1902
The Golder's Green Crematorium, London	„ 1902
The Birmingham Crematorium	„ 1903
The City of London Corporation Crematorium, Ilford, Essex	„ 1905
The Leeds Crematorium	„ „
The Bradford Corporation Crematorium. ...	„ „
The Sheffield Corporation Crematorium. ...	„ „

It seems reasonable to anticipate that before long almost every large centre will be provided with a crematorium.

HISTORY OF THE MOVEMENT IN LEICESTER.

In Leicester a movement in favour of cremation has existed for many years, and Leicester is one of the comparatively few towns in which a branch of the Cremation Society of England exists. This branch was formed in 1886, with Mr. Wm. Simpson as Honorary Secretary, in which capacity he has acted ever since. The membership is about 80. When the scheme for making a new cemetery came before the Town Council, pressure was brought to bear upon that body to include in the scheme a crematorium, and one or more petitions were presented. Fortunately, the movement had an influential supporter in the late Sir Thomas Wright, who, as a prominent member of the Town Council, was able to be of great service in putting forward the case for cremation. These efforts were finally successful, and a crematorium was included in the new cemetery.

Only one cremation took place in 1902. The following year there were 5, then 8, and last year 15. Many of these were from neighbouring towns, and almost all were of persons belonging to the upper or middle classes, this being the experience everywhere. As the fashion spreads, however, there is little doubt, I think, that the working classes will also avail themselves of cremation.

DESCRIPTION OF THE LEICESTER CREMATORIUM.

The following description of the Leicester Crematorium is taken from the printed regulations:—

"The Crematorium at the Gilroes Cemetery is annexed to the East end of the South Chapel, in which Chapel the funeral service may take place. This may be held either before Cremation or afterwards, as convenience or feeling may dictate."

"The cremating apparatus is a furnace of the regenerative type, designed by the late Mr. Henry Simon, President of the Manchester Cremation Society, and erected by Messrs. Henry Simon, Limited, of Manchester. Described in the briefest possible manner, it consists of three interior chambers, the two lower of which are surrounded by air passages. The lower chamber contains a coke fire, and the upper or incinerating one is that in which cremation takes place. The fire is lit some hours before the apparatus is to be used, and is supplied with air in the usual way. By the time the apparatus is ready for use the walls of the air passages are thoroughly heated. Most of the direct air supply is then cut off, and the partially consumed gas (carbonic oxide) from the coke is allowed to mix in the second chamber with the air heated by passing through the side air passages. The incinerating chamber is thus filled with gas of an intensely oxidising character in a state of incandescence. The degree of heat can be regulated in the most exact manner. There is no smoke and little visible flame before the body is introduced, and with a coffin made in accordance with the directions given, there is no smoke and no noise during cremation. The process occupies from 1 to 1½ hours, at the end of which time there remains only the inorganic residue of the bones, consisting of silvery grey pumice-like fragments. These are removed by passing an asbestos brush through the chamber, which causes the remains to fall through an opening into the urn which is to receive them, and they are not otherwise handled in any way."

"It should be explained that the interior of the cremating chamber is at no time visible to mourners. The coffin, when brought into the chapel, is placed upon a catafalque. When the committal sentence in the religious service is reached, it passes noiselessly by means of an invisible mechanical arrangement into an intermediate chamber, the doors of which close behind the coffin before it enters the cremating chamber. Throughout the process of cremation there is absolutely nothing to offend the senses, and there is nothing which savours of irreverence to the dead."

CREMATION ABROAD.

In several foreign countries the movement, begun about the same time as in this country, is making equal progress. In Germany cremation was introduced in 1878, and is rapidly increasing. According to statistics

recently published there are nine crematoria and eighty-six cremation societies, with a membership of more than 22,000. The figures are the more remarkable inasmuch as cremation is forbidden in several of the German states.

In the United States of America there are already no less than twenty-six crematoria.

In France there are four, but the one at Paris is used to a far greater extent than the corresponding one in London. In Switzerland there are four, and there are two in Sweden, and one in Denmark. Other countries which possess crematoria are Japan, Canada, and Australia; whilst one is also to be found at Buenos Ayres, and one is being founded in Bombay by educated Parsees, who object to the present method of exposing their dead on the Towers of Silence.*

As regards the number of cremations performed, in Paris alone (up to the end of 1903), the total amounted to 3,147, and it has since been considerably increased. In the United States no less than 3,160 took place in one year—1902. In Germany the number in one year (1903) was 1,074. In Great Britain there were 604 during 1905, as compared with 566 in 1904 and 476 in 1903; whilst the total for this country since the commencement of cremation up to the end of 1905 was, 5,020.

These facts speak for themselves, and show what progress cremation is making throughout the civilised world.

Funeral Reform.

The question of cremation is intimately associated with the question of funeral reform. That there is much in connection with our present funeral customs calling for reform most thinking people will admit. One cannot but regret, for instance, that so much money should be lavishly spent upon the dead in useless display, whilst so many of the living are in actual want; and the pomp and ceremony attending many a rich man's funeral seems almost a mockery when we reflect that we "brought nothing into this world, and it is certain we can carry nothing out." We see the same foolishness, in a slightly different form, in the practice of bygone civilisations of burying money and valuables in the grave. We want to see more simplicity and humility in our funerals; more evidence that we realise that after death worldly differences cease to exist. Cremation, from its very nature, does not lend itself so readily as inhumation to ostentatious display, and it is calculated, I think, to be an important influence in bringing about funeral reform.

* Freeman, "Crematoria in Great Britain and Abroad." St. Bride's Press, Ltd.

THE COST OF CREMATION.

This brings us to the question of the relative cost of cremation and inhumation. Cremation is not necessarily the expensive affair some people appear to think. The amount of fuel required to completely consume the human body, in the latest form of apparatus, is only about half a ton of coke, costing a few shillings, and against the cost of the fuel there is a set off in the saving of land required for the grave.

The interest and sinking fund on the capital outlay in building a crematorium, and the cost of up-keep, are serious items at present, whilst the number of cremations is small, but they will diminish greatly as the practice becomes popular.

The fees for cremation at the Leicester Crematorium are £2 2s. for a resident of Leicester, and £5 5s. for a non-resident. In the case of a poor person the Corporation may, if they think fit, remit a portion or a whole of this. In addition to the cost of the actual cremation there are the fees for the special medical certificates required by law. At present, cremation is unfairly handicapped in this respect, as no fee is payable for the nominal certificate of death which is all that is required before burial. It is probable, however, that the law will soon be amended so that proper medical certificates of death will be required, and will have to be paid for, in any case.

THE CREMATION ACT, 1902.

Whilst it is most desirable, of course, that cremation should be properly regulated, and that adequate precautions should be taken to prevent its being used for the purpose of concealing crime, it is possible that the procedure required under the Cremation Act before a cremation can take place, might safely be made somewhat more simple. There is a great contrast between the stringent precautions insisted upon before cremation and the notoriously inadequate precautions which the Law is at present satisfied with before burial. Briefly, the procedure before cremation is as follows:—a statutory declaration has to be made, on a prescribed form, before a Justice of the Peace or Commissioner of Oaths, to the effect that there is no known cause why cremation should not take place. Two medical certificates have to be obtained, also on prescribed form, one from the ordinary medical attendant, and the other (the confirmatory medical certificate) from a medical man of not less than five years' standing, and who holds some official position specified in the Regulations, such as Medical Officer of Health, Certifying Factory Surgeon, Medical Referee under the Workman's Compensation Act, or Physician or Surgeon to a

hospital. The ordinary medical certificate of the cause of death has to be given, and the death registered, as usual. Lastly, all certificates have to be submitted to the Medical Referee appointed by the Cremation Authority under the Act, and no cremation can take place until authorised by him. The Medical Referee has full power to decline to allow a cremation to take place without stating any reason, and in any case where he thinks it desirable he may require that a *post mortem* examination be made.

Although I think that some of the details of this procedure might be simplified with advantage, it is not really so formidable as it sounds, and when *all* deaths have to be properly certified, the difference in trouble between cremation and burial will be less marked.

The Comparative Advantages of Cremation.

We must now consider the arguments in favour of cremation as compared with inhumation, and we may, for convenience, divide them into two classes:

1. On Sanitary grounds.
2. On Sentimental grounds.

1. *On Sanitary grounds.*—We are justified in claiming that the practice of inhumation in crowded graveyards in our large towns is essentially insanitary, and must be a menace to the health of the surrounding inhabitants; and as regards intra-mural interments, the revelations which came to light as the result of the inquiry into this subject some thirty years ago smote the public with such horror, that an Act of Parliament was passed prohibiting this form of interment. Of course where cemeteries are built at a distance from the towns, out in the open country, as is the case at Leicester, the evil is greatly reduced. The process of decay and corruption still goes on, though the effect upon the living is necessarily minimised. At the best, however, the process is very objectionable to any one who pauses to reflect.

It has been proved experimentally by Pasteur and others that the germs of certain infectious diseases, *e.g.*, anthrax, may survive in the soil surrounding the grave for long periods, even years, after an animal dying of that disease has been buried; also that these germs may be brought to the surface by earth worms and re-infect fresh animals. How far similar results may follow the burial of human beings dying of infectious disease I cannot say, and though it has been alleged to occur, we may hope, in the absence of definite proof, that it is a rare occurrence.

In considering this aspect of the question, viz., the possible influence

of a cemetery upon those living in the vicinity, I am able to speak with some personal feeling, as my own residence is in close proximity to the Leicester cemetery, a narrow strip of only forty yards separating my garden from the cemetery fence. In this cemetery, the subsoil of which is a stiff clay, some 2,000 bodies, representing, perhaps, 100 tons of human remains, are deposited every year.

As regards any nuisance arising from the process of cremation, I can speak from experience, as nearly forty cremations have already taken place at the Leicester Corporation Crematorium, which is only 300 yards from my house. I have never noticed the slightest nuisance; nor, indeed, from the nature of the apparatus, is any nuisance possible, even if it took place in a crowded neighbourhood. A light puff of smoke when the coffin is first introduced is all that reveals the fact that a cremation is taking place, and even this, I believe, can be overcome.

2. *On Sentimental grounds.*—We now approach what, after all, is probably the most important aspect of this question, viz., the appeal to sentiment. It is sometimes said that popular sentiment is against cremation. No doubt this is so at present, because cremation is new and strange, whilst interment is old and familiar; but whoever seriously considers the fate which inevitably befalls the body after it has been placed in its last resting place must surely admit that, apart from prejudice, sentiment should be in favour of cremation.

As this is an aspect that requires to be treated by a master's hand, if it is to be done without offence, I will quote from a lecture* by the Rev. C. Voysey, member of the Council of the Cremation Society, and one of its original founders. He says:—

> "I pass on now to the æsthetic advantages of cremation, and the first of these is the reverence and honour which it pays to the body of the dear departed. You have only to contrast cremation with burial to see this at once. Anyone with sufficient powers of imagination, instructed by the knowledge of well-known facts, can picture to himself the loathsome process which goes on in the buried coffin. No indignity or contumely could be worse than that offered to the body of our nearest and dearest by subjecting it to this horrible process of lingering decay . . . . Now all this loathsome process of corruption is of course rendered impossible by cremation. In the crematory chamber the body is quickly but surely consumed (in about one and a half hours), the small residue consisting of a few pounds of white and grey ashes . . . . These are reverently collected and placed in an urn, which may be disposed of according to the wishes of the relatives: either by being buried in a churchyard or cemetery with accustomed rites, or bestowed in columbaria belonging to the crematorium, or buried in the garden

* Published by Williams & Norgate.

> surrounding it. But from first to last there is nothing to offend the most refined taste, nothing to shock or outrage our most sensitive feelings. Everything is clean, quiet, decent, and reverent; and when we later take the precious remains into our hands, we are unutterably thankful that our beloved one can never pass through the filth of decay, never be eaten of worms, never make the eye or the olfactory nerves to shrink or shudder. In short, the dear body shall, in the words of the Psalmist, 'never' even 'see corruption.' . . . . Custom dies hard; and so prejudice in favour of burial and against cremation will linger long . . . . But if anyone tells me that he, as a survivor, still prefers burial and shudders at cremation for his nearest and dearest, I will tell him how I stood by an open grave one day fifty years ago; my eldest brother, whom I loved intensely, was about to be lowered into that damp and gloomy pit, and my quivering heart followed him down, down into it, and I realised all the horror of the outrage to which his precious body would be soon exposed. The terrible thought haunted me for weeks, months, and years after. But from that day forth I set myself to think and dream how that horror could be done away with, and some sweeter, less excruciating method for the disposal of the dead could be discovered."

In the above quotation the case for cremation on sentimental grounds is eloquently expressed and fairly presented, and I venture to think that it will be chiefly on these grounds that cremation will eventually become popular.

Whether cremation will ever entirely supersede burial I cannot, of course, say; possibly both methods will always have their supporters. But as cremation becomes more and more familiar, most of the existing prejudices will certainly disappear, and with the advent of greater facilities, we may confidently look for a very great extension of the practice in the near future.

Dr. Boobbyer (Nottingham) said, that, viewed simply from a public health standpoint, cremation was entirely acceptable and open to no objection; but we could not shut our eyes to the fact that on sentimental grounds, on religious grounds (so far as the Roman Catholic Church was concerned), and on medico-legal grounds (because it destroyed, with the body, all traces of the cause of death) it was open, in the estimation of a very large proportion of the general community, to very serious objection. In all probability the sentimental objection would be the hardest to overcome. The religious objection was also a serious one, when it implied, as it did, the opposition of the Roman Hierarchy. With regard to the legal objection, there could be no doubt it was to some extent well founded. For example, many murders with irritant poisons, like arsenic, would have remained undetected but for the possibility of exhumation and chemical examination some time after burial. Personally, he was strongly in favour of cremation, but that did not prevent his seeing that the opposition it had to face was, to say the least, extremely formidable. A large amount of exhumation

and clearance of old burial places had taken place in recent years in Nottingham under his supervision. This work, of course, was necessitated by the old system of intra-mural burial. Much of it afforded a powerful object lesson in favour of cremation, especially where the bodies had been buried in lead. He had known a hideous nuisance to be occasioned by the bursting of a lead coffin buried a century before. At the present time in Nottingham they were beset with the difficulty of inducing people, especially poor people, to carry their dead outside the city, and this notwithstanding the special lessons just mentioned in the evil of intra-mural burial in the past. Reviewing the position of cremation calmly and dispassionately, he had come to the conclusion that, while it was certain on its merits to increase in popular favour as time went on, it was destined to share the field with earth to earth burial for many a long day; it could not hope to supersede it entirely. The history of the past in this regard certainly favoured such a conclusion. Indeed, except where cremation had been adopted on more or less religious grounds, it had never apparently enjoyed as much popularity as burial, among any race or at any time of which we had the records. The business of the undertaker in one form or another had necessarily been a regular one since man first appeared on the planet, and our forefathers had doubtless thought about this matter very much as we do now. Cremation appeared to have been practised to some extent even in the Stone Age. Urns containing incinerated human remains had been found in tumuli at various spots (Stonehenge) in this country and elsewhere. Nations descended from the ancient Aryan fire-worshippers had commonly burnt their dead. The oldest of this family, the Hindoo, does it still. In the Heroic age of Greece, and later, it seemed to have alternated indifferently with burial. Socrates (classic period) was offered the alternative in his own case, and expressed indifference on the point, leaving it to be decided by his friends. Burial and cremation were practised side by side among the Romans. Cæsar and Tacitus, respectively, tell us of the use of both methods of disposal among the Gauls and Germans. Cremation was discontinued in Rome about the end of the 4th century, owing probably to Christian influence. With the sanitary renaissance of the 19th century we had a revival of its advocacy among the nations of Europe, after a desuetude of nearly 15 centuries. This revival, however, had been only a slow one. We had now 13 crematoria in this country, and only 604 cremations last year. The principal moral to be drawn from what he had said might be summed up he thought in two words, *festina lente!* (hasten slowly). We should provide crematoria, and endeavour to popularise their use, but we should not overdo their advocacy, and above all things we should avoid any attempt to force cremation upon the British Public.

COUNCILLOR G. CHETHAM (Leicester) said that he welcomed them to Leicester, and thanked them for bringing before that meeting the important question of the cremation of the body instead of earth burial; not only as being

a more sanitary way of the disposal of the remains, but even on the sentiment side a more reverent and pleasant way to remember those who were dear to them. If they could only see the remains after a few weeks or months of earth burial, they would never wish to remember them in that state, especially in Leicester with its stiff clay soil. It was to be hoped that Parliament would lessen the restrictions that at present exist, as the expense of two or three certificates before cremation was very heavy, and the certificates for earth burial cost nothing. He wished also that their burial authorities could still more reduce the fees to the very poor, seeing they had not to find land.

Dr. W. Collingridge (London) pointed out that it was not necessary to insist upon the sanitary advantages of cremation as a means of disposal of the dead. This was fully recognised by the thinking part of the community who had given attention to the subject, and others would follow in their train. Nor was it necessary to further trouble much as to the style and type of furnace to be employed. While there was a demand, the supply might safely be left in the hands of the engineers, who certainly could produce a furnace which, if not absolutely perfect, would at any rate do its work easily, safely, cheaply, and without causing any nuisance. At the City of London Crematorium, Little Ilford, the furnace in use had given perfect satisfaction. It was capable of reducing a body to about two per cent. of its original weight in about one hour, without the production of smoke or any objectionable vapour. Objection had been raised to cremation on the score of expense and difficulty in obtaining the necessary certificates. This was greatly exaggerated. All that was necessary was: (i.) the certificate of the attending medical practitioner, which was given in all cases now; (ii.) a confirming certificate given by a medical man holding certain qualifications, which should not cost more than 21s., in many cases 10s. 6d. only; and (iii.) certificate of medical referee. Certainly in the case of municipal crematoria there should be no charge for this last. Any alteration as to formality of certificates should be by way of levelling up the present system, and not by cutting down the reasonable safeguards laid down by the Cremation Act. The one great obstacle in the way of cremation was prejudice, sentiment, which could not be disregarded, but which must be thought of and considered in every possible way. The crematoria should be constructed amid attractive surroundings; the actual buildings should be tastefully designed, and of a somewhat ecclesiastical type. The hall or chapel should be ornamental, and decorated freely with shrubs, palms, and flowers. Special arrangements should be contrived so that, when the body passes into the furnace chamber, nothing should be visible to the mourners. Cremation was slowly but steadily increasing in vogue in this country, and to make it popular it was only necessary to consider in every possible way those sentimental objections which an enthusiast is so liable to disregard, but which form so strong an obstacle to the progress of any new movement.

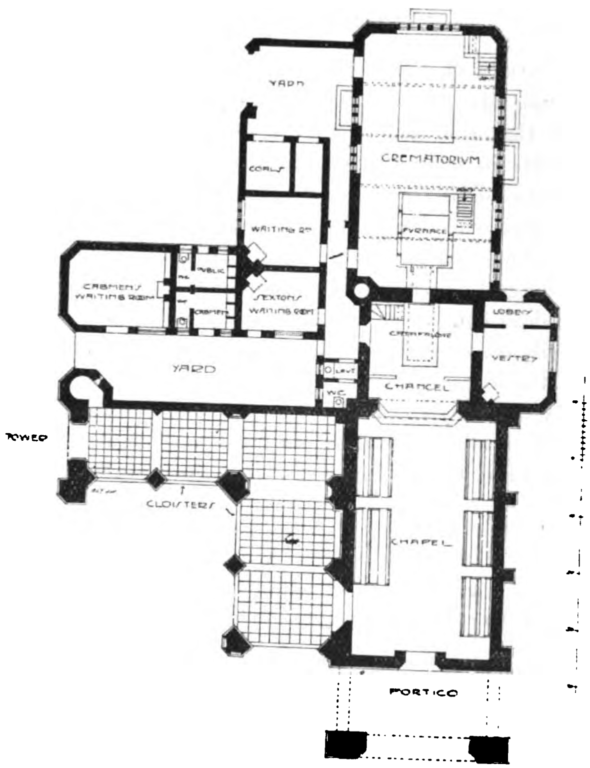
ALDERMAN T. WINDLEY (Leicester) expressed his pleasure that the Institute had visited Leicester again, but hoped the next time they came they would discuss a less lugubrious subject. On sanitary grounds he supposed there could be no doubt that cremation was superior to the ordinary method of burial, but confessed he was unable to get up any enthusiasm on the subject. Dr. Boobbyer had very correctly stated the strong sentiment which prevailed, and which would long stand in the way of the new system. Personally, where a suitable subsoil was available, he was inclined to favour "earth to earth" burial in preference to cremation.

MR. W. A. CLARKE (Leicester) said that he was a little disappointed that Dr. Millard had not laid greater stress in his paper on the evils of earth burial as he considered that the strongest arguments against earth burial were the strongest arguments in favour of cremation, as cremation was the only practicable alternative to burial for the disposal of the dead. He said that the evils and horrors of earth burial should be continually brought before the public. He advocated the American methods of advertising the claims of cremation, and said he would even go further and shock people with the revolting details of the condition of the dead body after burial, and felt sure that the claims of cremation, if only calmly considered, would at once be admitted. He went on to say that he did not think it could be shown that cremation was contrary to Biblical teaching, and it was chiefly those who were weak on the doctrine of the spiritual resurrection of the dead who brought forward the religious argument; while a large number of leading Churchmen and Nonconformists were strongly in favour of cremation.

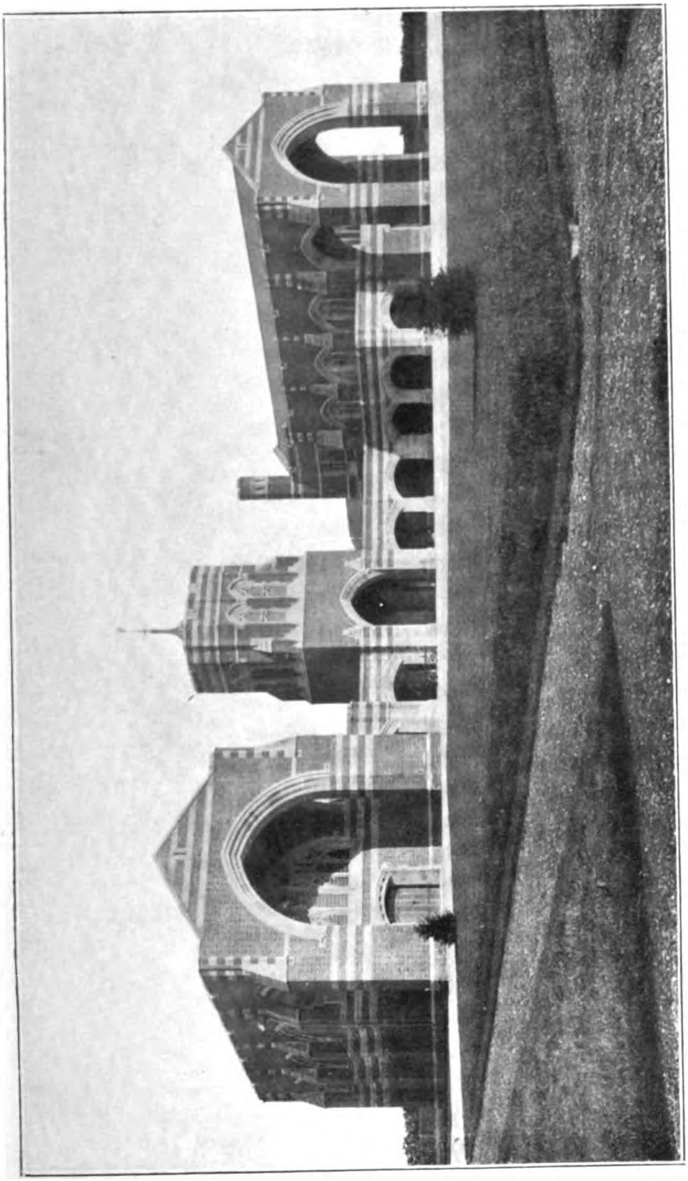
DR. C. KILLICK MILLARD (Leicester), in reply, said he did not regard the medico-legal objection as a serious one in view of the precautions taken before a cremation could take place. It had been shown that even with the present lax system of earth burial, without proper certificates, the number of instances in which exhumation had been called for was only very small. It was true that sentiment at present was, so far as the masses were concerned, against cremation, but the practice of the ancients showed that sentiment might be in favour of it, *i.e.*, that there was nothing in cremation innately opposed to popular sentiment; indeed, his contention was that, apart from custom and prejudice, sentiment was likely to be in favour of it. He thanked the meeting for the way in which his paper had been received.

MR. A. H. PAGET (Leicester), the architect of the Crematorium, described the buildings and the furnaces used. A plan and view of the building are given at pp. 258 and 259; these illustrations are, by permission of Mr. A. C. Freeman, taken from his book on "Crematoria in Great Britain and Abroad."

MR J. E. WILLCOX (Birmingham) also took part in the Discussion.



Crematorium and Chapel, Leicester.



Leicester Crematorium.

Volume XXVII. No. 5. Issued June, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

BUILDINGS IN GARDEN CITIES.

By H. D. SEARLES-WOOD, F.R.I.B.A.,
(FELLOW).

ADDRESS TO ANNUAL MEETING OF ASSOCIATES.

ON

Tuesday, March 27th, 1906.

THE often quoted address of Dr. Benjamin Ward Richardson on "Hygeia, a City of Health," was delivered at Brighton, in the year 1875, and I thought it might be interesting to extract from that address those points which relate to our subject to-night, in order to see how far the suggestions made 30 years ago have been realised.

"Our city, which may be named Hygeia, has the advantage of being a new foundation, but it is so built that existing cities might be largely modelled upon it."

"The population of the city may be placed at 100,000, living in 20,000 houses built on 4,000 acres of land, an average of 25 persons to an acre. This may be considered a large population for the space occupied, but since the effect of density on vitality tells only determinably when it reaches a certain extreme degree, as in Liverpool and Glasgow, the estimate may be ventured."

"The safety of the population of the city is provided for against density by the character of the houses which ensures an equal distribution of the population. Tall houses overshadowing the streets and creating necessity for one entrance to several tenements are nowhere permitted. In streets devoted to business, where the tradespeople require a place of mart or shop, the houses are four storeys high, and in some of the western streets where the houses are separate, three and four-storeyed buildings are erected; but on the whole it is found bad to exceed this range, and as each storey is limited to 15 feet, no house is higher than 60 feet."

"The substratum of the city is of two kinds, at its northern and highest part there is clay, at its southern and south eastern, gravel. Whatever disadvantages might spring in other places from a retention of water in a clay soil is here met by the plan universally followed of building every house on arches of solid brickwork. So where in other towns there are areas and kitchens and servants' offices, there are here subways through which the air flows freely, and down the inclines of which all currents of water are carried away."

"The acreage of our model city allows room for three wide streets or boulevards which run from east to west, and which are the main thoroughfares. Beneath each of these is a railway, along which the heavy traffic of the city is carried on. The streets from north to south, which cross the main thoroughfares at right angles, and the main streets which run parallel, are all wide, and owing to the lowness of the houses are thoroughly ventilated, and in the day are filled with sunlight. They are planted on each side of the pathways with trees and in many places with shrubs and evergreens. All the interspaces between the backs of houses are gardens. The churches, hospitals, theatres, banks, lecture-rooms, and other public buildings, as well as some private buildings, such as warehouses and stables, stand alone, forming parts of streets and occupying the position of several houses. They are surrounded with garden space, and add not only to the beauty but to the healthiness of the city. The large houses of the wealthy are situated in a similar manner. The streets of the city are paved throughout with the same material. As yet wood pavement set in asphalte has been found the best. It is noiseless, cleanly, and durable. Tramways are nowhere permitted, the system of underground railways being found amply sufficient for all purposes. The side pavements, which are everywhere ten feet wide, are of white or light-grey stone; they have a slight incline towards the streets, and the streets have an incline from their centres towards the margins of the pavements."

"From the circumstance that the houses of our model city are based on subways there is no difficulty whatever in cleansing the streets—no more difficulty than is experienced in Paris; the accumulation of mud and dirt in the streets is washed away every day through side openings into the subways, and is conveyed with the sewage to a destination apart from the city. Thus the streets everywhere are dry and clean, free alike of holes and open drains. It will be seen from what has been already told, that in this our model city there are no underground cellars, kitchens, or other caves; there is not permitted to be one room underground. The living part of every house begins on the level of the street. The houses

are built of a brick which has the following sanitary advantages. It is glazed and quite impermeable to water, so that during wet seasons the walls of the houses are not saturated with tons of water, as is the case with so many of our present residences. The bricks are perforated transversely, and at the end of each there is a wedge opening, into which no mortar is inserted, and by which all the openings are allowed to communicate with each other. The walls are in this manner honeycombed so that there is in them a constant supply of common air let in by side openings in the outer wall, which air can be changed at pleasure and, if required, can be heated from the firegrates of the house."

"The bricks intended for the inside walls of the house, those which form the walls of the rooms, are glazed in different colours according to the taste of the owner, and are laid so neatly that the after adornment of the walls is considered unnecessary, and indeed objectionable. By this means those most unhealthy parts of household accommodation, layers of mouldy parts and size, colour-stuff or distemper, are entirely done away with. The walls of the rooms can be made clean at any time by the simple use of water, and the ceilings, which are turned in light arches of thinner brick or tile, coloured to match the walls, are open to the same cleansing process. The colour selected for the inner brickwork is grey, as a rule, that being most agreeable to the sense of sight, but various tastes prevail, and art so soon ministers to taste that in the houses of the wealthy delightful patterns of work of Pompeian elegance are soon introduced. As with the bricks, so with the mortar and the wood employed in building: they are rendered as far as possible free of moisture. Sea-sand containing salt, and wood that has been saturated with sea-water, two common commodities in badly-built houses, find no place in our modern city."

"The most radical changes in the houses of our city are in the chimneys, the roofs, the kitchens and their offices. The chimneys, arranged after the manner proposed by Mr. Spencer Wells, are all connected with central shafts into which the smoke is drawn, and after being passed through a gas furnace to destroy the free carbon, is discharged colourless into the open air. The city therefore, at the expense of a small smoke rate, is free of raised chimneys and of the intolerable nuisance of smoke."

"The roofs of the houses are but slightly arched, and, indeed, are all but flat. They are covered either with asphalte, which experience out of our supposed city has proved to last long and to be easily repaired, or with flat tile. The roofs, barricaded round with iron palisades tastefully painted, make excellent out-door grounds for every home. In some

instances flowers are cultivated on them. The housewife must not be shocked when she hears that the kitchens of our model city and all the kitchen offices are immediately beneath their garden roofs—are, in fact, on the upper floor of the house instead of the lower. In every point of view, sanitary and economical, this arrangement succeeds admirably. The kitchen is lighted to perfection, so that all uncleanliness is at once detected. The smell which arises from cooking is never disseminated through the rooms of the house. In conveying the cooked food from the kitchen in houses where there is no lift, the heavy weighted dishes have to be conveyed down, the emptied and lighter dishes up stairs. The hot water from the kitchen boiler is distributed easily by conducting pipes into the lower rooms, so that in every room and bedroom hot and cold water can at all times be obtained for washing or cleansing purposes; and as on every floor there is a sink for receiving waste water, the carrying of heavy pails from floor to floor is not required. The scullery, which is by the side of the kitchen, is provided with a copper and all the appliances for laundry work, and when the laundry work is done at home the open place on the roof above makes an excellent drying ground."

"In the walls of the scullery is the upper opening to the dustbin shaft. This shaft, open to the air from the roof, extends to the bin under the basement of the house. A sliding door in the wall opens into the shaft to receive the dust, and this plan is carried out on every floor. The coal-bin is off the scullery, and is ventilated with the air through a separate shaft which also passes through the roof."

"On the landing in the second or middle storey of the three-storeyed houses there is a bath room supplied with hot and cold water from the kitchen above. The floor of the kitchen and of all the upper storeys is slightly raised in the centre and is of smooth grey tile, the floor of the bath room is the same. In the living-rooms, where the floors are of wood, a line oak margin of floor extends two feet around each room, over this no carpet is ever laid. It is kept bright and clean by the old-fashioned bees-wax, and impurities in the air are ozonised by the process. Considering that a third part of the life of man is or should be spent in sleep, great care is taken with the bed-rooms, so that they shall be thoroughly lighted, roomy, and ventilated. Twelve hundred cubic feet of space is allowed for each sleeper, and from the sleeping apartments all unnecessary articles of furniture and of dress are rigorously excluded."

"Old clothes, old shoes, and other offensive articles of the same order, are never permitted to have residence there. In most instances the rooms on the first floor are made the bed-rooms, and the lower the living-rooms.

In the larger houses bed-rooms are carried out in the upper floor for the domestics. To facilitate communication with the kitchen and the entrance hall so that articles of food, fuel and the like may be carried up, a shaft runs in the partition between the houses, and carries a bucket-lift in all houses that are above two storeys high. Every heavy thing to and from the kitchen is thus carried up and down from floor to floor and from the top to the basement, and much unnecessary labour is thereby saved. In the two-storeyed houses the lift is unnecessary, a flight of outer stairs leads to the upper or kitchen floor."

"The warming and ventilation of the houses is carried out by a common and simple plan. The cheerfulness of the fireside is not sacrificed, there is still the open grate in every room, but at the back of the firestove there is an air-box or case, which, distinct from the chimney, communicates by an opening with the outer air, and by another opening with the room. When the fire in the room heats the iron receptacle, fresh air is brought in from without and diffused into the room at the upper part, on a plan similar to that devised by Captain Galton, F.R.S."

"As each house is complete within itself in all its arrangements those disfigurements called back premises are not required. There is a wide space, consequently, between the back parts of all houses, which space is in every instance turned into a garden square, kept in neat order, ornamented with flowers and trees, and furnished with playgrounds for children young and old."

"The houses being built on arched subways, great convenience exists for conveying sewage from and for conducting water and gas into the different domiciles. All pipes are conveyed along the subways and into each house from beneath. Thus the main of the water-pipe and the mains of the gas are within instant contact on the first floor of the building, and a leakage from either can be immediately prevented. The officers who supply the commodities of gas and water have admission to the subways, and find it most easy and economical to keep all that is under their charge in perfect repair."

"It has been found in our towns generally that men and women who are engaged in industrial callings, such as tailoring, shoe-making, dress-making, lace-work, and the like, work at their own home amongst their children. That this is a common cause of disease is well understood. In the model city these dangers are met by the simple provision of workmen's offices or workrooms. In convenient parts of the town there are blocks of buildings designed mainly after the manner of the home, in which each workman can have a workroom on payment of a modest sum per week.

Here he may work as many hours as he pleases, but he may not transform the room into a home."

"Each block is under the charge of a superintendent, and also under the observation of the sanitary authorities. The family is thus separated from the work, and the working man is secured the same advantages as the lawyer and the merchant now possess; or, to make the parallel more correct, he has the same advantages as the man or woman who works in a factory and goes home to eat and to sleep. In most towns throughout the kingdom the laundry system is dangerous in the extreme. For anything the healthy householder knows, the clothes he and his children wear have been mixed before, during, and after the process of washing with the clothes that have come from the bed or the body of some sufferer from a contagious malady. In our model community this danger is entirely avoided by the establishment of public laundries under municipal direction. No person is obliged to send any article of clothing to be washed at the public laundry, but if he does not send there he must have the washing done at home. Private laundries that do not come under the inspection of the sanitary officer are absolutely forbidden. It is incumbent on all who send clothes to the public laundry from an infected home to state the fact. The clothes thus received are passed for special cleansing into the disinfecting rooms. They are specially washed, dried, and prepared for future wear."

"Passing along the main streets of the city we see in twenty places equally distant a separate building surrounded by its own grounds: a model hospital for the sick. To make these institutions the best of their kind no expense is spared. Several elements contribute to their success. They are small and are readily removable. The old idea of warehousing diseases on the largest possible scale, and of making it the boast of an institution that it contained so many hundreds, is abandoned here. The old idea of building an institution so that it shall stand for centuries like a Norman castle, but, unlike the castle, still retain its original character as a shelter for the afflicted, is abandoned here. The still more absurd idea of building hospitals for the treatment of special organs of the body, as if the different organs could walk out of the body and present themselves for treatment, is also abandoned. It will repay us a minute of time to look at one of these model hospitals. One is the *fac simile* of the other, and is devoted to the services of every five thousand of the population. Like every building in the place it is erected on a subway. There is a wide central entrance, to which there is no ascent, and into which a carriage, cab, or ambulance can drive direct. On each side the gateway

are the houses of the resident medical officer and of the matron. Passing down the centre, which is lofty and covered in with glass, we arrive at two side wings running right and left from the centre and forming cross-corridors. These are the wards, twelve on one hand for male, twelve on the other for female patients. The cross corridors are 12 feet wide, and 20 feet high, and are roofed with glass."

"The corridor on each side is a framework of walls of glazed brick, arched overhead, and divided into six segments. In each segment is a separate light, elegant, removable ward, constructed of glass and iron, 12 feet high, 14 feet long, and 10 feet wide. The cubic capacity of each ward is 1,680 feet. Every patient who is ill enough to require constant attendance has one of these wards entirely to himself, so that the injurious influences on the sick which are dreaded by mixing up in one large room the living and the dying; those who could sleep were they at rest with those who can not sleep because they are racked with pain; those who are too nervous or sensitive to move or cough or speak lest they should disturb others and those who do whatever please them; these bad influences are absent. The wards are fitted up neatly and elegantly; at one end they open into the corridor, at the other towards a verandah, which leads to a garden. The wards are warmed by a current of air made to circulate through them by the action of a steam engine. If at any time a ward becomes infectious it is removed from its position and is replaced by a new ward. It is then taken to pieces, disinfected, and laid by ready to replace another that may require temporary ejection."

"The few who are insane are placed in houses licensed as asylums, but not different in appearance to other houses in the city. Here the insane live in small communities under proper medical supervision, with their own gardens and pastimes."

It will be seen that there are still many of the points made by Dr. Richardson yet to be taken up in building a model city.

Taking the question of height of buildings, I was struck the other day looking at some photographs of Winnipeg, one of the latest developed cities in Canada, to see that they were building houses of twelve and fifteen storeys, and when I was told later that land in the centre of the city was sold at the highest price per foot ever given for land, it seemed all the more strange. Apparently there is no physical reason like the island site of New York to account for the larger buildings. Winnipeg is situated on a plain that affords boundless means of expansion.

The modern experience of manufacturers, however, is in favour of even

one-storey factories when the price of the land is not prohibitive, and I know of some factories which cover an acre of space all under one roof. The advantage of this, from a manufacturer's point of view, is ease of supervision. The question of adequate means of escape in case of fire and the proper ventilation and heating of such big cubic contents, raise novel points, but should not be difficult of solution. The system of construction is a series of ridge and furrow roofs, carried on iron supports.

The question of limit of area to buildings of this class is being rapidly brought to the front, in the sheds which are required for storing and attending to the motor buses that are being erected in the outskirts of large towns, the Building Act limit of 250,000 cubic feet being much too small.

The method of raising all buildings on arches above the ground has been practised for hospital buildings, but has not been used for private dwellings owing to the cost; it has much to recommend it, *only* the space underneath the house must be sufficiently high to make it get-at-able and so kept clear of rubbish, and until the people are educated up to the appreciation of absolute freedom of air circulation around their houses the space would be sure to be the store-house of all kinds of rubbish.

The perforated bricks described have been used, but they have not taken hold on the public. One of the objections to them is, the way they behave in cases of fire, the face of the brick flying off when the brick is heated and water is turned on. With regard to the case of glazed bricks for the internal surface of walls and ceilings, I think experience has shown that a glazed surface such as those present does not make a comfortable room to occupy, and the usual method at present adopted is to confine the glazed work to a dado about four feet high, and above that to use plaster and some kind of paint or distemper.

The use of concrete blocks made with air spaces inside is being advocated, and it forms a cheap and useful method of building; one of the best of the £150 cottages built at Letchworth was built of this material. Re-enforced concrete, that is concrete in which steel bars are introduced in position to take up the strains, is making rapid progress, and some notable buildings have recently been erected in this way, the advantages being that the constructive work is practically homogeneous and the steel is adequately protected in the case of fire. But it must be borne in mind that the element of weight in our solidly built brick structures is not entirely useless, and if the slighter methods of construction which re-enforced concrete allows be employed, the question of wind pressure has to

be taken into account and the building adequately braced to counteract it.

The method of treating the smoke by connecting all the flues with central shafts where the smoke is driven through a gas furnace, the free carbon is destroyed, and the products of combustion discharged colourless into the open air has not yet been tried, but at the recent Smoke Abatement Exhibition a patent was shown which did this in the individual flue; in the 4-in. iron smoke shaft a combustion chamber was inserted, the smoke passed through, and the whole of the free carbon destroyed.

The flat roofs advocated have been tried, and not always with success. The usual method is to cover the space with concrete and lay the asphalte on the top, but care must be taken to prevent the expansion of the concrete pushing the walls out; I knew of this being the case in a building erected by the London School Board in the South of London, the flat roof of the building expanded and pushed the walls out of place. Another objection is that if no false ceiling is made to the rooms under, the moisture in the air is apt to condense on the ceiling.

There is a new method of roofing by means of a material called ruberoid, which is a preparation of india-rubber laid in two or three thicknesses and covered with gravel; when skilfully laid this makes a cheap and durable roofing material, but I have not heard how it behaves in case of fire.

The suggestion of placing the kitchen at the top of the house has been tried, but has not met with public approval, and I think that there are obvious drawbacks.

The hospital with the wards made to be easily taken down and disinfected has yet to be realised, but there is much to be said in favour of a simpler style of building for the treatment of disease.

I hope I have not tired you by dwelling so long on Dr. Richardson's address, which, although often referred to, is, I fancy, but very little read now-a-days.

At the recent Conference on Garden Cities, Mr. Lever advocated the standardisation of cottage buildings in order to cheapen the cost of building. There is no doubt that a saving can be effected by making the various parts of a house, such as the doors, windows, staircases, etc., in uniform series, and the general dimensions of rooms are more or less fixed; but I think it is to be hoped that such a system may not result in the dreary monotony with which we are unfortunately so familiar in some of our London suburbs.

The exhibition of cheap cottages at Letchworth last year has, I am

afraid, given rather a wrong impression; the garden city there is one thing and the cheap cottage exhibition was another, and in many ways the exhibition showed what to avoid rather than what was the latest idea on the subject. As this exhibition was the subject of a paper by Mr. Aldwinckle and Dr. Sykes, I do not propose to touch on it to-night, only just to make these remarks in passing. In a circular widely distributed, giving designs and particulars of cheap country cottages, the walls of which are of timber framing either covered with weather boarding or corrugated iron, the following note is interesting:—

"Building By-laws.—With certain exceptions it is our experience that, provided these Timber Framed Dwellings are beyond certain specified distances from other structures, permission is not withheld. In many cases an undertaking to remove the buildings within 10 years if called upon to do so has induced the Council to pass the plans. As can be understood, this in most instances eventually means that the buildings are allowed to stand for an indefinite period."

I have always understood that the objection to buildings of this class was not so much their liability to fire as that this method of construction was not suitable for human occupation; on account of the walls and roof being such good conductors the buildings were too hot in summer and too cold in winter, and that they are very liable to become verminous, but it is evident that a good many of these buildings are erected and occupied, and the public authorities, such as the London County Council, in their Lunatic Asylum at Horton, have made use of this method of construction, the building has been occupied for several years, and it has been found to be quite satisfactory. It is curious to note that in such hot places as Suez and Western Australia corrugated iron is used for the roof and walls; in fact, there is hardly anything else used in Western Australia on account of the scarcity of water; every drop of rain has to be saved, and therefore the most non-absorbent material used for roofs.

The address was illustrated by 54 lantern slides.

NOTE ON A DEEP WELL BORING IN CHELSEA.

By LOUIS C. PARKES, M.D., D.P.H.,

Medical Officer of Health, Chelsea.

(FELLOW.)

THIS boring has been made to supply water for the new Public Baths now in course of erection by the Chelsea Borough Council in Manor Street, adjoining the Town Hall, and about a quarter of a mile from the River Thames.

The diameter of the steel bore tube is 13½ inches, and the tube is sunk for 260 feet from the engine-room floor, terminating 5 feet down in the chalk. The boring through the London Clay was made with a scoop, but where hard beds had to be pierced a punching chisel was used. In the chalk the latter instrument was used, and a shell 11 feet in depth was used for lifting the chalk to the surface. The boring was done by a hand drill, four men being at work. The lifting of the bored material was effected by a steam winch. The men engaged in boring made an average of 74 working hours per week. The upper end of the bore tube is encased in a protecting tube 15½ inches in diameter, which is sunk as far as the clay, or 30 feet down from the engine-room sump.

The work was commenced on the 14th September, 1905, and the boring ceased on the 24th February, 1906, at a depth of 463 ft. 8 ins. from the crown of the roadway in Manor Street. The average rate of sinking for the whole bore is about 3 ft. 5 ins. per day, but in the chalk the average rate was 4 ft. 3 ins. per day.

The contract price for the boring was for the first 100 ft. 17s. per foot, increasing 1s. per foot for every 100 ft. sunk. The contractors were Messrs. E. C. Potter & Co., Lant Street, Borough, S.E.

The following Table shows the various strata and their depth, as excavated and bored, commencing from roadway level :—

			Thickness.	Depths.
Top Soil			2′ 6″	2′ 6″
River Drift	Sand and gravel	16′ 9¾″	22′ 3¾″	24′ 9¾″
	Gravel, water-bed	4′ 0″		
	Brown clay and gravel	1′ 6″		
London Clay	Brown clay	0′ 6″	148′ 6″	173′ 3¾′
	Blue clay with six layers of clay stone [septaria], two a foot thick, the rest six inches	143′ 0″		
	Basement-bed, sand, shells, and pebbles.	5′ 0″		
Reading Beds	Mottled clay	43′ 6″	47′ 0″	220′ 3¾″
	Dead sand and pebbles	3′ 6″		
Thanet Sand	Dead green sand	7′ 0″	45′ 6″	265′ 9¾″
	Dead sand	37′ 6″		
	Green flints	1′ 0″		
Upper Chalk			197′ 11″	463′ 8¾″

After reaching water in the flints above the chalk, there was water in the boring all the way down until the total depth of 463 ft. 11¾ ins. was reached. The water now stands in the boring at a depth of 120 feet from the surface. No analysis has as yet been made of the water.

The total cost of the well with plant complete (not including boilers) will be £1,153 5s. The pump will be supplied by the Rand Drill Company, New York, U.S.A., and will be a cross compound steam and cross compound air compressor, type No. 10, with a lifting capacity of 12,000 gallons per hour. The total capacity of the storage tanks will be about 120,000 gallons.

The baths to be supplied with water will be:—

One large swimming bath, 100 ft. by 30 ft. and 7 ft. deep at deep end.

One small „ „ 96 ft. by 38 ft. „ „ „

90 private slipper baths (30 1st class, 60 2nd class).

There are no washhouses for use by the public, but there will be a laundry for establishment purposes.

The Architects for the Baths are Messrs. Wills and Anderson, and the Engineer to the Baths is Mr. Alexander McDonald, who will be pleased to show specimens of the bored strata, now preserved in his office, to anyone who is interested.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

ADULTERATION.—*Sample—Purchase for Analysis—Mode of Dividing Sample —Sale of Food and Drugs Act, 1875 (38 & 39 Vict. c. 33), s. 14.*

Where an article of food is purchased for the purpose of analysis under s. 14 of the Sale of Food and Drugs Act, 1875, each of the three parts, into which the article is required by that section to be divided, must be sufficient to admit of a proper analysis being made of that part.

LOWERY *v.* HALLARD. Div. Ct. 1 K. B. 398.

HOSPITAL.—*Public Health—Infectious Hospital—Discharge of Patient while still infectious—Liability of Local Authority—Public Health Act, 1875 (38 & 39 Vict., c. 55), ss. 124, 131, 132.*

The defendants, a local authority, acting under the provisions of the Public Health Act, 1875, provided for the use of the inhabitants of their district a hospital for the reception of persons suffering from infectious diseases. A visiting physician, who was a competent medical practitioner, was appointed to the hospital, and acted under the general directions of the hospitals committee of the defendants, the rules providing (inter alia) that he should be responsible for "the treatment of the patients from the beginning to the end of their stay, and also for their freedom from infection when discharged." A son of the plaintiff was treated in the hospital while suffering from a mild attack of scarlet fever, and was ultimately discharged by the visiting physician while still in an infectious condition, and under circumstances which a jury found to amount to a want of reasonable skill and care on his part in and about the discharge: after the boy had returned home, he communicated the disease to three other children of the plaintiff. The plaintiff then sued the defendants to recover the expense to which he had been put in regard to the illness of his other children owing to the premature discharge of his son from the hospital by the visiting physician:—

Held, that the plaintiff was not entitled to recover, for the legal obligation of

the defendants extended only to the provision of reasonably skilled and competent medical attendance for the patients, which they had discharged, and that there was no absolute undertaking or obligation on their part that no patient should be discharged by the visiting physician while still in a condition which might cause infection.

EVANS *v.* LIVERPOOL CORPORATION.

WALTON J. (1906) 1 K. B. 160.

HOUSE REFUSE.—*Removal of House Refuse—Failure of Sanitary Authority to remove—Reasonable cause—Public Health (London) Act, 1891 (54 & 55 Vict., c. 76), s. 30.*

By a by-law of the London County Council, made under s. 16 of the Public Health (London) Act, 1891, it was provided that, where a sanitary authority arranged for the daily removal of house refuse in their district or in any part of it, the occupier of any premises therein should, at such hour of the day as the sanitary authority should fix and notify by public announcement, deposit on the kerbstone or on the outer edge of the footpath immediately in front of the house or in a conveniently accessible position on the premises as the sanitary authority might prescribe by written notice served upon the occupier, a movable receptacle in which the house refuse should be placed for the purposes of removal. A sanitary authority, desiring to start a system of daily removal of house refuse, and assuming to act under the by-law, gave notice by means of a printed notice to all the occupiers of houses within a specified area, requiring them to deposit on the kerbstone or edge of the footpath immediately in front of their respective houses a movable receptacle in which should be placed for the purposes of removal the house refuse which had accumulated since the preceding collection; the notice contained a statement that the dustmen were prohibited from going on the premises for dust in the streets within the prescribed area.

An occupier of a detached house standing back forty feet from the highway, and approached by a carriage drive, who had a conveniently accessible position on his premises in which he was willing to put his house refuse in a movable receptacle for purposes of removal, refused to comply with the notice by placing his house refuse in a receptacle on the kerbstone, and the sanitary authority refused to remove his house refuse from his premises, notwithstanding the service upon them by him of a written notice, under s. 30 of the Public Health (London) Act, 1891, requiring them to do so. A summons was taken out under s. 30, sub.-s. 2, of that Act by the occupier against the sanitary authority for unlawfully and without reasonable cause failing to comply with the notice to remove the house refuse from his premises, and the sanitary authority were convicted of the offence charged:—

Held, that the notice was not a proper prescription of a conveniently accessible position as contemplated by the by-law, that it went beyond the by-law in

prescribing that every occupier within a given area must place his house refuse in a receptable on the kerbstone; that the sanitary authority had therefore failed without reasonable cause to discharge their statutory duty of securing the removal of the house refuse from the premises of the occupier, he being willing to place it in an accessible position from which they could conveniently remove it, and that the conviction was right.

WANDSWORTH CORPORATION *v.* BAINES (Appeal).
Div. Ct. (1906) 1 K. B. 470.

PRIVIES AND CESSPOOLS.—*Power of Local Authority to undertake duty of Cleansing—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 42.*

A local authority may, under s. 42 of the Public Health Act, 1875, undertake the cleansing of earth-closets, privies, and ashpits in their district without at the same time undertaking the cleansing of cesspools.

STANILAND AND HOLYWELL GREEN INDUSTRIAL CORN AND PROVISION SOCIETY *v.* STANILAND WITH OLD LINDLEY URBAN DISTRICT COUNCIL.
Div. Ct. (1906) 1 K. B. 223.

STREETS.—*Regulation of Streets—Power of Local Authority to apportion Expenses out of their District—Local Government—Public Health Act, 1875 38 & 39 Vict. c. 55), s. 150.*

The Birkbeck Freehold Land Society were the owners within the meaning of the Public Health Act, 1875, of premises adjoining the footpath on the north side of the Birkbeck Road, which is a highway not repairable by the inhabitants at large. The boundary line between the Borough of Hornsey and the Friern Barnet Urban District runs along the line of the kerb of the footpath on the north side of the Birkbeck Road, so that while the whole of the carriage road and the footpath on the south side of the road are in the Borough of Hornsey, the footpath on the north side and the premises of the Birkbeck Freehold Land Society are outside the borough and within the urban district of Friern Barnet.

The appellants, acting in pursuance of s. 150 of the Public Health Act, 1875, having served notice on the respondents requiring them to make up certain parts of the Birkbeck Road situate in the borough, ultimately carried out the work themselves, and sought to recover from the respondents an apportionment of the cost. The Justices held that there was no power to charge the respondents with any part of the cost of making up that portion of the road which was situate in the Borough of Hornsey and declined to make an order, but stated this case for the opinion of the Court.

The Court upheld the decision of the Justices on the ground that there was nothing in s. 150 of the Public Health Act, 1875, which enabled a local authority

to apportion expenses of making up a road in their district on persons whose property, though abutting on the road in question, was nevertheless situate in another district. It lay on the appellants to establish their right to apportion expenses on persons outside their district, and they had failed to do so. The principle, therefore, laid down in *Reg. v. Warner* (1858), 27 L. J. M. C. 144 applied.

HORNSEY CORPORATION v. BIRKBECK FREEHOLD LAND SOCIETY.
Div. Ct. (1905). 1 K. B. 521.

WATER-CLOSETS.—*Repairing Apparatus of existing Water-closets—Requirement of Notice to Sanitary Authority before doing work—Public Health (London) Act, 1891; 54 & 55 Vict., c. 76), s. 39, by-law 14.*

By by-law 14 of the by-laws made under s. 39 of the Public Health (London) Act, 1891, "Every person who shall intend to construct any water-closet . . . . or to fit and fix in connection with any water-closet any apparatus or any trap or soil pipe shall, before executing any such works, give notice in writing to the clerk of the sanitary authority."

The appellants, in 1905, had occasion to renew the pans and traps of certain water-closets at one of their railway stations, which pans and traps had become defective by ordinary wear and tear. The water-closets in question had been constructed before 1891. The appellants, having done the necessary work without first giving notice to the clerk of the sanitary authority, were summoned for a breach of the above by-law. The magistrate convicted the appellants:—

Held, that the by-law applied to the fitting of apparatus in connection with an existing water-closet as well as to the fitting of it in connection with a water-closet constructed after the making of the by-law.

LONDON AND SOUTH-WESTERN RY. CO. v. HILLS (Appeal).
Div. Ct. (1906). 1 K. B. 512.

Volume XXVII. No. 6. Issued July, 1906.

JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

DISCUSSION ON

THE CONSUMPTIVE AT HOME.

Opened by G. A. HERON, M.D., F.R.C.P.,

(MEMBER.)

At Sessional Meeting, London, April 27th, 1906.

IT has been officially communicated to me that this meeting is not intended for doctors alone, and that I am to speak in such a way as not to make this address a technical one, or as little so as possible.

Now, in the course of the discussion on which we are entering two words are certain to occur frequently, tuberculosis and consumption. Tuberculosis is a disease which may attack any tissue of the human body, from the outermost layer of the skin to the marrow of the bones. When it attacks the lungs, tuberculosis in ordinary conversation is called consumption. There is no race of men, no country in the world, of which we have any knowledge, exempt from this disease. Its mortality is very great, no one knows how great. In this country where statistics are carefully kept, we know the rate of that mortality. It is the most fatal of all diseases. According to the Registrar-General's Report there died, in the year 1904, in England and Wales alone, from tuberculosis in one form or another, 50,000 people; of these, 40,000 and an odd hundred or so died of consumption.

When you look at a consumptive you see a person who owes his disease to the fact that he has been infected by another case of tuberculosis, probably a case of consumption. There is no exception to this rule; the disease always comes directly or indirectly from another case of tuberculosis. You have heard consumption called a hereditary disease. It is always a hereditary disease, but only in this sense:—We have all

inherited from our ancestors some physical peculiarity, no one knows what it is, which makes us susceptible to certain infections, scarlet fever, measles, typhoid fever, typhus fever, cholera, tuberculosis. To all these infections we are susceptible, because we inherit from our ancestors that peculiarity which lays us open to those infections. In that sense and in no other sense, I submit, is tuberculosis a hereditary disease. Now, how does tuberculosis pass from the diseased man to the healthy man? I will take an illustration. A consumptive goes along the street and he coughs, and he spits on the pavement. So long as that expectoration is wrapped in its moist envelope it does no harm; but, by and by, this moist envelope evaporates, and the solid particles of the expectoration make dust, and in this dust you have literally tens of thousands of little living organisms, and they are the cause of all tuberculosis. They belong to the great family of bacteria, and are called tubercle-bacilli. These organisms are animal parasites, and are exceedingly small. You can put from 3,000 to 12,000 of them in the length of an inch, and they are about a third of their length in breadth. The dust from dried expectoration is, like other dust, wafted about by the wind; someone passing may inhale that dust, and with it many of these little organisms which cause consumption, and so you may have a healthy man made consumptive. So far as we know, that is the commonest way in which tuberculosis spreads from man to man. But there are other and not quite such obvious ways in which the expectoration of the consumptive is dangerous. When a man speaks little particles of spray drop from his lips, and we know by observation and by experiment that in the case of a consumptive that spray not infrequently contains tubercle-bacilli. Again, when a man coughs he spurts out a considerable volume of spray, and observation and experiment tell us that that little cloud of spray may contain considerable numbers of tubercle-bacilli if the cougher be a consumptive. It is only from the expectoration that infection comes; this is most important, because on that fact hinges the means for the prevention of consumption. From gross ignorance a consumptive may spread infection; but I think it is much more frequently done because of that more dangerous and commoner form of ignorance which is found in a man who does not quite understand what he is sure he knows. Many men do not apprehend clearly the great danger that comes from the expectoration of consumptives, and so with the ignorance of carelessness they make infection in the rooms they occupy.

The great cause of the spread of consumption is overcrowding. Where there is the densest residential population, there consumption

is rifest. The sparser the population the rarer is consumption. Overcrowding exists to a much greater extent than most of us suspect. Sir Shirley Murphy, the medical adviser of the London County Council, has published some valuable statistics concerning tenements in the administrative county of London. He shows that its population is 4,536,541, and there are 1,019,546 tenements; of these 672,030 are tenements of four or fewer rooms. 149,524 are one-roomed tenements; and oftentimes there exist in one room a man, his wife, their family and, it may be, a lodger! In tenements of that sort the infection of tuberculosis is most apt to spread.

We can to a great extent get rid of the infective properties of the expectoration by disinfection properly carried out. But it is unreasonable to expect that disinfection can be properly carried out in the dwellings of the extremely poor, unless the work is confided to trustworthy officials.

Another great cause of the spread of tuberculosis is the abuse of alcohol. Accepted evidence proves that the person given to alcoholic excess is much more apt to fall a victim to the infection of tuberculosis than is the sober person.

I have said that ignorance has a great deal to do with the spread of tuberculosis, as it has to do with the spread of all infective diseases. Of course, only in one way can we get rid of ignorance, and that is by educating the people. I wish that we could find in the Education Bill, of which we hear so much, some measure which would make it sure that all children, in the last year of school life, would receive instruction in the elements of the laws of health. Above all things I should like to see it made a law of the realm that all pupils in our training colleges should show, before they receive their certificates of proficiency, a fair knowledge of the laws of health. Then we might have a chance of having our children taught something of this very important subject.

I said that overcrowding had a great deal to do with the spread of tuberculosis; to get rid of overcrowding is one of the most troublesome problems of the day. We can only get rid of overcrowding by building suitable dwellings within certain districts in large cities and towns; or, better still, by placing those dwellings in the suburbs of large cities and towns and taking care that speedy and frequent communication shall exist between those suburban dwellings for the workers and the points in the city where work is most likely to be found.

I have also mentioned disinfection as a remedy, and in order to illustrate what I mean by disinfection and how it should be carried out, let me take two cases at the opposite ends of the social scale. At one end

of the scale is the rich man; at the other end is the poverty-stricken man. Suppose the rich man becomes consumptive. By means of his wealth he can do certainly all that is necessary, and all that we can suggest he should do to cure his disease. He lives in well-aired rooms in a large house. His rooms are arranged in the most approved style, with all that sanitary science can suggest; he has no carpets, no curtains, and the floors and walls of his rooms can be easily disinfected, because they are made so that this can be done. His furniture is made so that there shall be no crevices where dust can accumulate, because dust in the rooms of a consumptive is dangerous. The furniture, his clothes, his linen and everything he uses can be properly disinfected. When he expectorates he does so, as it were, under regulation, and with as little danger as possible to himself and others. He can go out into the grounds of his house; and if he is well advised he will there build a little hut in which he will live and sleep. He thus lives the healthy outdoor life which, so far as we know, is the life that will give him the best possible chance of getting rid of his disease. With all this, he has doctors to advise him and nurses to look after him, and his disinfection is properly carried out by persons who know their work. All this he does because he can afford to do it, and because it is necessary that he should do it. This comes very near to a counsel of perfection; but it can be done.

Now let us go down the scale, to the poor man who lives with his wife and family in one room. When he is ill what does he do? He feels that he is not quite equal to his work, and that what used to be easy to him is more than he can do. He knows that the time is near when the only thing that will stand between him and starvation is the sick fund that he has from his club. He knows that by and by that too will come to an end; these are the conditions that he has to face. Do you think it reasonable to suppose that a man so placed can carry out a complete system of treatment, such as I tried to indicate would be the case when the consumptive is a rich man? It is not reasonable to suppose anything of the sort, and no sensible man or woman believes it can be done. What does the poor man do? He goes to the out-patient department of a hospital (I am speaking only of out-patients) and he gets medicine and a piece of paper with instructions as to what he is to do; he goes home, takes the medicine, and tries to carry out the instructions on the printed paper about disinfection. But how can he do it? Then in a week's time the consumptive goes back again to the hospital, gets more medicine, and returns to his home; and so on until, at last, he goes into hospital, very likely hopelessly ill. Ladies and gentlemen, that is not

a fancy picture; we have all seen it. If you want to do real good you will first of all end this pretence of treating consumption, for it is nothing else than a pretence. No one believes it serves a useful purpose, unless you can add to the hospital treatment of out-patients, visitation by trustworthy people in the sick man's own rooms. I believe the present day system of treatment of consumptives given by our out-patient departments does more harm than good. How are you going to get this visitation of the consumptive's home? We must have three forces working cordially and heartily together. The Imperial Parliament should legislate so that we can have the money and the men to work out this matter. The local Sanitary Authorities should be obliged to come under parliamentary jurisdiction for this purpose. Those are two of the powers. We want another one. I think it very important that private benevolence should play a great part in this matter. People who can give money should give it; those who can give personal service will give what is about as necessary as money. If the poor are visited in their houses by those who are not officials, in addition to receiving the visits of those who come in an official capacity, I think the work of the official would be made easier and more efficient than it otherwise would be. I am certain of this, that the bitterness of the lot of those who find themselves obliged to be brought into official contact with the powers that be, a process which in this country is not always favourably received by the poor, might be very much lessened by tactful visitation made by unofficial persons of both sexes to the homes of the poor to see that what ought to be done is done. The best visitor to do this work is a good and tactful woman; but man has his place too.

There is one more point, and it also is essential. We must have sanatoria in which to place these poor people. I have already indicated that with the rich we need not trouble ourselves; they can take very good care of themselves. This whole question of the prevention of consumption seems to me to centre in how you are going to deal with the poor. If you can remove the sick man from his family, you can give him a better chance of recovery than he could possibly have in his own home, and you can diminish very materially the risk of those who live in prolonged contact with him. You must have sanatoria for this purpose. I said that 50,000 people die annually from this disease in England and Wales. If you count five living people who are suffering from tuberculosis for every one who dies, you have, in round figures, a quarter of a million of people affected by tuberculosis to deal with, and this is, I think, a moderate calculation. Now the names and addresses of all those people ought to be known to the authorities, whether those invalids are rich or

poor. The disease ought to be notified, just as is scarlet fever or any other infective disease which now comes under the law of notification. The authorities knowing where tuberculosis shews itself should take steps to induce the infected, rich and poor alike, to go into sanatoria. It is true that a large number of people leave the sanatoria restored to health and able to work. Statistics from reliable sources have shown this to a degree which, I confess, has astonished me. In Germany the insurance societies have taken the matter up, and have started sanatoria because they think it will pay them to do so. They have, within the last few weeks, published most valuable statistics, in which they show that a very large number of consumptives return to work from these sanatoria. Between 1893 and 1903 (inclusive) there were treated in these sanatoria 5,814 persons. Of these 1,228 have died, 3,955 were earning their living, and the rest cannot be traced.

We want to get consumptives into sanatoria in the early stages of the disease in their own interest, in the interest of those who are nearest and dearest to them, and in the interest of the whole community. We must not make the mistake of supposing that these people are going to be in the sanatoria for 6 weeks or for 6 or 12 months, if we are going to aim at the eradication of this disease. The patients have to be kept there until they are well and able to work, or until they become so ill that they have to be transferred to an infirmary where, they being incurable and the end inevitable, everything possible may be done to make their lot as bearable as it can be made. These are things which, in my judgment, we ought to keep before us as the means, and the only means, by which, so far as I know, we can ever hope to eradicate this disease. Remember we have a good many facts which prove that we can eradicate disease. It is within the memory of some of us that cholera killed thousands in this country. We have eradicated it, because we know what cholera is, and we know how to prevent it. I was a house physician in one of the largest hospitals of this country, and saw there many cases of typhus fever at the end of the sixties, and I do not remember having seen one case since 1869. I see many medical men here, and venture to say that there are some of them who have never seen a case of typhus fever. A case now and then crops up, but the disease has been eradicated; and we have eradicated malaria from this country. It is a reasonable thing to say that we can eradicate tubercular disease, because we know more about it than we know about some diseases which we have already eradicated. But if we are to attempt to eradicate tuberculosis we must provide sanatoria at greatly less cost than £250 per bed. That is about the lowest price for which sana-

toria for consumptives are now built. It is a fact that very good sanatoria, fit, indeed, for any class of the community, can be built, and have been built, for much less than £100 per bed. In my opinion, no sanatorium should, exclusive of the price of land, cost so much as £100 per bed.

DR. E. SQUIRE (London) endorsed all that Dr. Heron had said, and especially his concluding remarks, that we should aim at nothing short of the eradication of tuberculosis. Parliament should deal with the subject as a national one, instead of leaving it as a parochial matter to the local authorities. The poor consumptive could not get fresh air in his own dwelling, and therefore he must be provided for a time with a dwelling where fresh air was plentiful, and he must be under proper supervision. Obviously, they could not set to work to help the individual until they knew who required that help; so that notification was the first essential. Only a small proportion of the total cases were then notified: it was the most ignorant consumptive who was the most dangerous, and he was generally the one who refused to be notified for fear that something would happen to him and he would lose his freedom of action. If the hospitals, to which such patients went, were to ask to be allowed to notify, these institutions would probably get a bad name amongst the people concerned, and they would cease to attend. The result would be that the cases in an early and often curable stage would be deterred from seeking treatment at a time when most good could be done. If notification were to be of any real value it must be made compulsory and universal. But notification by itself was valueless, it was only a means to an end. A consumptive should be allowed to remain at home, provided the necessary precautions could be taken (chiefly a question of dealing with expectoration) and the correct treatment applied. There was every reason why he should not be forced away from home. But where these conditions could not be fulfilled, it was better that the patient should be taken to a sanatorium. It would be a great advantage if the patient could be kept in that institution until he was well, but that might be a matter of years. It would be desirable to divide the sanatoria into departments, for those who were sick enough to require constant medical attendance; for those in whom the disease had been arrested; and for those who were apparently cured and could be under observation while being taught some work until it was seen they could leave with safety.

DR. T. ORME DUDFIELD (Kensington) insisted on the necessity of compulsory notification of consumption; voluntary notification had existed in Kensington during the last four years, and had proved a relative failure. The notifications scarcely exceeded the number of deaths, and were almost exclusively

confined to cases in receipt of poor-law relief reported by poor-law medical officers. Scarcely more than one in four cases of actual occurrence, he believed, came to his knowledge, and a large proportion of them was revealed only by certification of death. The pauper cases reported were usually in the later stages of the disease, the victims after long struggle having been obliged to resort to the relieving officer and the parish doctor by reason of destitution no less than sickness. He could say little about consumption in the well-to-do classes, it being a rare thing to hear of their illness until it had ended fatally. There were some 200 deaths in Kensington yearly from pulmonary phthisis, and among them scarcely a dozen of well-to-do people. Consumption was, in fact, largely a disease of the poor, and they would not be able to do much by way of prevention without compulsory notification to secure knowledge of cases in the early stage of the disease. Dr. Heron had properly enforced the necessity for sanatoria, and that the sick should go into them in the early stage of illness and remain for a long time. Excellent advice indeed if only there were sanatoria for them; but for those above the pauper class there were practically none. The Metropolitan Boards of Guardians had provided largely for the needs of the pauper class, and many sanatarians had long striven, so far in vain, to induce the Asylums Board to utilise some of their spare accommodation for the relief of poor consumptives about the pauper class. They could not do this, of course, without the authority of the Local Government Board; but they had shown little desire to undertake the work, and the superior board had not manifested any wish to confer the requisite power. The managers had, or soon would have, ten thousand beds at their disposal, and it had been suggested that the two hospitals at Gore Farm, with nearly 2,000 beds, no longer required for convalescent small-pox patients, should be converted for use as sanatoria. The managers were entitled to credit for two good pieces of work, the establishment of a hospital near Littlehampton for tuberculous children, and the establishment at Margate of a hospital for the surgical treatment of tuberculosis in children. On the highest authority it was stated that excellent results had been attained at both places. It should never be forgotten that multitudes of people became paupers because they were consumptives. But the Local Government Board had recently stated that they were not prepared to authorise the Asylums Board to undertake the new duty proposed to them, because of the heavy outlay it would entail: they might not spend £100,000 to save a million. It was deplorable to reflect on the practical disregard of the welfare of the community in this matter, seeing that the great majority of sufferers and of those who died of consumption, were adults, chiefly males, in the prime of life. Millions had been spent during the last thirty-five years on the treatment of scarlet fever and diphtheria, which were mostly diseases of children under five years of age. The work of the Board in this direction had been marvellously successful, and one hoped it would be continued until those diseases should have been practically exterminated in London, if

that were possible. But surely it was not less important that efforts should be made to reduce the sickness and mortality from consumption, and to prolong useful lives by giving sufferers the chance of relief in sanatoria. If they could only educate those in authority, from Parliament downwards, to realise that this disease was preventible, and often curable, it would soon be seen that it was true economy to spend money freely in preventive and curative measures. The disease was becoming less fatal every year, and what they wanted was to hasten the diminution in prevalence and fatality. By persistent effort and education of the community, the young especially, in the laws of health, and attention to sanitation, the object in view would be soon attained. There was a great field for the education authority in this direction, and it was satisfactory to know that the work would be put in hand when the future teachers should have been taught, and were qualified to teach, the elements of hygiene. What they wanted was spread of knowledge of the nature of the disease, of the means for preventing its spread, of the method of cure. When it became fully understood that it could be prevented and could be cured, satisfactory results could not fail to result from the practical application of such knowledge. He was glad to see the Chairman of the Metropolitan Asylums Board presiding over that meeting, and only wished they could infuse into that body a little more courage in dealing with this question. A few years ago a single manager, the late Mr. Brass, kept the matter before the Board by frequent notices of motion, and shortly before his lamented death had nearly won the victory. Since then the managers had lapsed into comparative indifference, having shown no desire to take the initiative by urging the Local Government Board to endow them with powers to deal effectively with the treatment of sufferers from this terrible disease.

DR. SHRUBSALL (London) agreed with what had been said by previous speakers as to what might be done with consumptives provided the conditions were ideal. But the practical point was that they had to be dealt with under present conditions. Reference had been made to the uselessness of treating consumption in hospital out-patient departments; he thought it all depended upon the physician who was in charge of the department. If the physician did not take a personal interest in his patients, no good would result; but if on the contrary he was thoroughly keen on the subject, and took trouble with his instructions, much good would result. Antiseptics had now largely gone out of fashion, even in surgery, and he favoured disinfection by soap and water, which very few families could not afford. If they could persuade people to throw away their dirty carpets and curtains, and to wash the floors, enormous advance would be made. The best disinfectant was soap and water. A bacillus had not got wings and could not fly, if it were kept moist it was harmless. They should impress the use of a pot for expectorating. A thing that was often overlooked was the use of a handkerchief to wipe the mouth, and that handkerchief was capable of doing much harm. It was better to use only rags which could be

destroyed, care being taken in employing them not to soil the bed clothes. He also suggested the need of advising the dusting of rooms with a damp duster. If these simple rules were observed it was certain that ultimately the germs would travel into the drains. The great doctrine the doctor had to teach was cleanliness, and if adopted, it would have a great deal to do with the extermination of tuberculosis in this country.

Miss Mudd (London) emphasised the need of some link between the hospital and the home, because it was possible for a patient to go to a hospital and yet be neglected. As to expense, this ought to be no expense to the hospital as the work would be done voluntarily.

Dr. Hector Mackenzie (Physician to the Brompton Hospital) said he largely agreed with Dr. Heron as to the infective element, but thought Flügge had laid too much stress upon the spraying during speaking and coughing. Personally he had very little belief in that as a means of spreading consumption. He had spent something like 10,000 hours among coughing consumptives without harm, and the nurses in consumption hospitals, who were often in the line of spray, seemed to run no special risks. If there was any very great virulence or infection in the spray, very few of those exposed to it would escape, and consumption would be very much more prevalent than it is. Recent experiments of B. Fränkel had not supported the views held by Flügge, and showed that only a very few bacilli were to be found in the spray collected from consumptives. A number of consumptives coughed into masks during thirty days, and they were only able to collect about 2,600 bacilli, whereas one single case of consumption may discharge in the sputum over 7,200 million bacilli in the course of a single day. Dried expectoration was by far the most important element in the spread of infection, and the spray might practically be neglected. That was an important point, because there was the danger of the public running away with the idea that every consumptive was a sort of leper and someone to be avoided. He had found that persons who had been treated in sanatoria and cured sometimes experienced difficulty in obtaining employment, people being afraid to employ them through groundless fear of infection. He was glad to hear what Dr. Shrubsall said about infection; certainly cleanliness was a great disinfector. Dirt was one of the means by which tuberculosis was spread, and if people would only keep their houses clean it would be of the greatest value as a measure of prevention. Some people thought that all those who did not enter a sanatorium must abandon hope, and he had seen statements to that effect in prospectuses. That was perfect nonsense, because the tendency to cure in many cases of tuberculosis was very strong; some would get well without any treatment at all. There were, of course, many persons who would get treatment in a sanatorium infinitely superior to what they would get at home, but there were others who were extremely ill—cases which had to be treated continuously

in bed—who were more suitable for home or hospital. For those who only had slight tuberculosis and were able to work it was sometimes better that they should be encouraged to continue at their work. At Brompton they had lately been considering how the out-patient department could be extended and increased, and the committee which had the matter in hand had the assistance of Dr. Newsholme, of Brighton, who had been nominated by The Royal Sanitary Institute. They felt that notification was one of the most important means of helping on the prevention of the disease, and they hoped that they would be able to notify all cases of tuberculosis which come to the hospital from the metropolitan district to the metropolitan medical officers of health, with the hope that if they were so notified some action would be possible. He thought it would be impracticable for hospitals to take up the work of visiting patients in their own homes, because patients who came to a hospital like Brompton often came from very long distances, and visiting and disinfection ought to be carried out, along with other educational work, by the medical officers of health and others in the locality of the homes.

MISS JOSEPHS (Jewish Board of Guardians) observed that one body in London, the Jewish Board of Guardians, was taking up systematically the work of supervision of consumptives in their own homes. There were two health visitors appointed, and shortly the staff would be increased. They only attempted to help Jewish patients, and a very large number came to them, so that they already had more than they could deal with. Those who asked for help were sent to a doctor and he advised as to the proper treatment. The visitors then endeavoured to supervise the consumptive in his home and teach him the precautions he should take. Bottles and spittoons were provided, and it was insisted that they should be used; frequent visits were paid and they tried to prevent overcrowding. The Board conditionally helped families to secure larger and more rooms: they endeavoured, where possible, to obtain for the consumptive an apartment for himself, although very often this could not be managed. They had their own sanatorium and also sent patients to others, and their experience was that after patients left these institutions they soon dropped back again and wanted help once more. She was glad to hear of the practice at Brompton, but her experience of some hundreds of cases was that the patients were not able, after six months' treatment, to do a full day's work. What was to be done for them? Did they in Germany keep their patients two and three years in sanatoria? She had been working at a scheme which she believed was the only solution of the problem, *i.e.*, to arrange for persons leaving sanatoria to go to an open air colony and to work under the supervision of a doctor, where they could, if necessary, continue for the rest of their lives. She did not say that such colonies could be self-supporting, but it did at present seem to be a waste of money to send patients to sanatoria. She pointed to the need for dealing in some proper way with advanced cases. People would not go into infirmaries.

Besides, what accommodation was provided in infirmaries at the present time for consumptive cases? There were very few in London where special wards were provided; mostly they were placed with other cases and were a danger to the other patients. She thought it ought to be possible for several unions to join together for providing special accommodation.

The Chairman (A. C. Scovell, J.P.) in proposing a vote of thanks to Dr. Heron, said they were all pleased with the lucid aud illuminating address from which they had all learnt so much.

Dr. Heron, in acknowledgment, replied to Miss Josephs, and said the figures from Germany were as follows: 5,841 people treated in sanatoria in 1893, of those who had been traced 3,955 were now at work. That was the gross result and he would be glad to furnish the particulars. He had avoided the detailed aspect of disinfection designedly, but he quite agreed that cleanliness, fresh air and sunshine were best, although there were other disinfectants which were useful. They were all at one in regard to compulsory notification. As to whether a consumptive should be allowed to remain at home; in the present state of public opinion he could not be removed, but if the public were sufficiently educated he did not think they would have to employ compulsion. He did not know that rich consumptive patients were rare, but they were not very common. The fact that there were thousands of beds not in use, as mentioned by Dr. Dudfield, was, of course, not to the credit of the authority concerned, when they were wanted so badly for poor consumptives. He quite agreed as to the advising of out-patients, and it was good of Dr. Mackenzie to speak as he had done; but he did not think they would get the present race of out-patients in hospitals to-day to do much for themselves. They must be taken in hand and helped.

Mr. A. C. Scovell, J.P., replying to a vote of thanks for presiding, said, in reference to a remark by Dr. Dudfield, that the empty beds of the Metropolitan Asylums Board were reserved for fever and diphtheria. It was quite true there were some 2,000 empty at that season of the year when those diseases were not prevalent. But all the beds were full at the time of year when they were required, and they were extremely anxious not to have to refuse patients for whom by law the hospitals of the Board were established. He thought it desirable to mention this, as his Board might think him remiss in not defending their administration. As a matter of fact, individually and collectively, the Asylums Board took a great interest in the question just discussed, and would willingly do whatever the law permitted them to do.

Miss Gardner (London) who had not time to speak, sends the following note: I think much useful work might be done in connection with the patients who are waiting admission to the Chest Hospitals, if the hospital could refer

them to some local visitor, who would report upon the home conditions. Some patients can afford to wait much more than others, and by a little judicious advice and possibly for help with extra diet, may even improve whilst waiting. Others are going down hill faster and faster, and for their own sake and that of the community, should be induced to go into the infirmary. Possibly if some such plan were adopted it might also lead to some discrimination being exercised as to the admission of those who could not possibly improve at home, and yet were hopeful cases if taken in time. I know that this plan is full of difficulties from the point of view of the impartial treatment of all patients, and it would mean more trouble to the authorities who admit, but it is not impossible. With regard to those patients who are awaiting admission to a sanatorium, these are generally speaking, hopeful cases. I think a comparatively cheap and efficacious way of dealing with such patients might in many cases be adopted in suitable localities, in their own homes, under the supervision, if possible, of the district nurses, if not, of some wise lady visitor who understands something of such cases, and would work under a doctor's instructions. Take a small room, an "off-room" would do, remove the window and arrange it carefully for the patient's comfort. Have a diet list and see that it is followed. In conjunction with the local authorities, see to the proper disinfecting of everything that is used, and, when the patient is removed to the hospital, of the room. This plan is not, of course, for the lowest class of patient, but I believe we might get good results in many cases, and it would act as an object lesson and would impress upon the neighbours the fact that this is an infectious disease. I am personally prepared to superintend such cases, in this district, as an experiment. I believe that the difficulties are not insurmountable.

SANITARY ADMINISTRATION IN A HEALTH RESORT.

By PHILIP W. G. NUNN, L.R.C.P.Lond., M.R.C.S.Eng.,

Medical Officer of Health, Bournemouth.

(MEMBER.)

Read at Sessional Meeting, Bournemouth, May 26th, 1906.

FOR a period of 30 years, barring a short interval, I have filled the position of Medical Officer of Health for Bournemouth. Even at the beginning of the period it had gained for itself a reputation as a health resort. Its population at that time was about 7,000, with a rateable value of £30,000. To-day it has a population of over 66,000, and a rateable value of considerably over half a million. You will see that during this period there has been a very considerable and rapid growth. The public health responsibilities during the whole of the years that are passed have been unceasing, and the duty devolving upon the town authorities of striving to keep up the character of the borough as a worthy health resort has been most important. I do not like to say anything in a boasting spirit, but the town during the whole of this period has been able to present to the world a clean face, and a very high standard of public health, and never once during the whole of that period has anyone ever been able to say that the health conditions of the municipality were otherwise than satisfactory. We have never been troubled with any epidemic visitation whatever. It is true we have had outbreaks, but these have always been very limited, and quickly controlled. I may here mention that during the whole 32 years we have had nine outbreaks of variola, brought into the town from a distance, but every one of these outbreaks has been quickly controlled and stamped out. Enteric cases have been very few, and quite of a sporadic nature, rarely traceable to any sanitary

defects in our own borough. Of scarlet fever and diphtheria cases we have had just an ordinary amount, but these have never assumed any epidemic severity. Measles has on a few occasions given us some trouble, but as the education of the people progresses, I hope they will soon begin to understand that it is not necessary for their children to have this disease, and that it could be largely controlled if they were more careful. It is in the day schools of a town, of course, that this disease often assumes so wide-spread and rapidly-spreading a tendency. Perhaps it may be possible to have some more direct supervision of the schools of our towns than hitherto, but I think it is not right that either the educational authorities should rely solely on the public health authorities or expect their officers to do all the work in connection with schools just as part of their ordinary duties; if they do, I can only say that the responsibilities will in time become almost intolerable. I fully recognise that educative work in this direction is most necessary. To train teachers and children in the first principles of health is an all-important duty, and of national importance. To help in moulding and training new useful citizens for the age to come is one of the duties of a municipality. You cannot expect people to become healthy or to begin to think intelligently on hygienic matters until they are trained in the rudiments from their earliest years, but I think that in this direction many of the citizens of this borough do in their thoughts postulate an ideal of what health is or what it ought to be and may become in the future. We have in this town a very strong blending of active temperance workers and to that class, more perhaps than to any other in the community, must be given the credit for moral and mental understanding of this great perfection. The town as a whole ought to award to them its thanks for striving to build up a mass of sound healthy public opinion. I am one of those whose ideal of health is not confined to the physical plane only. The moral and mental aspects of this problem are equally important. It is in these respects that I may claim that our municipality has not been wanting.

WATER SUPPLY.

The quality and quantity of a public water supply of a health resort is perhaps the most important item. What an evolution we have seen in Bournemouth in thirty-two years! When I became the Health Adviser to the Governing Body this was one of those public matters to which I gave most particular attention. At that time the Bournemouth Gas and Water Company had acquired the very valuable right to supply Bournemouth with water. The works in those early days were very

limited, and when contrasted with the extensive and up-to-date conditions of their property of to-day, will give you some idea of the growth of Bournemouth. The Company quickly recognised that their best interests were identical with those of the town, and that if they wished to retain the confidence of the people they must spend money freely. In the early days the water was obtained from the Bourne and Kinson brooks, supplemented by some very pure springs close to the works. The water from these two brooks, which ran through a peaty district, often became coloured by the peat. The filtering area was too limited, and the area of the ground at the works was far too small. They sunk a large and expensive deep well. This well passed through a stratum which unfortunately gave an unpleasant twang and an aluminous taste to the water, and was thus unsuited to a town like Bournemouth. Money was spent lavishly; expensive engines were put in, etc., but it was not good enough, and the work was soon abandoned. The company then bought land and a mill at Longham, seven or eight miles from the town, tapped a large quantity of water but a few feet under ground which was on its way to the river bed, and the water was pumped to the extensive filtering beds at Alderney. They were still, however, not quite satisfied. A geological expert and engineers advised them to tap the chalk just to the north of the town of Wimborne. They sunk a deep well and drove adits into the chalk, and fortunately succeeded in obtaining an almost unlimited quantity of the purest, clearest and most excellent water. This made a splendid addition to their already extensive supply. In addition to these works they have quite recently laid down an up-to-date softening plant, in compliance with a request made by the Council under the provisions of the Act of 1896. The water-mains are placed in nearly every road in the County Borough area, with the exception of one or two small portions of the Winton and Moordown districts lately taken into the Borough. The water is submitted every month to a searching analytical and bacteriological examination, and generally the result is most satisfactory. I have no confidence in simply an analytical examination of a public water supply. During the whole of my experience as medical officer of health of Bournemouth I have never known a single case of illness which could be said to have been caused by the public water supply. I am pleased to bear my testimony to this fact.

We have never been short of water, and never stinted in the quantity of our supply, and I believe that for many years to come the quantity of water will be sufficient, even if the population gets over 100,000. The water is supplied to houses through iron pipes into galvanized iron

cisterns, and very many houses have provided a draw pipe from the main. This I always advise. In the very early days there might have been a necessity for using some method of domestic filtration, but this is now no longer necessary, and I and the sanitary inspectors always advise that a draw-off tap from the main should be affixed. To pass water through a medium in which may be retained the impurities, the dust, and vegetable débris which undergoes decomposition, and to think that you have thereby improved the safety and quality of drinking water is unreasonable and may be disastrous.

GOVERNMENT.

Bournemouth since 1890 has been under the wider government of a Mayor and Town Council. Previous to that it was governed by a Board of Commissioners, under whom I served for nearly twenty years. Compared with the numbers of the present governing body, they were small, but I am sure it will be agreed that the borough, as it now is, is an incontrovertible evidence of the value of the Commissioners' work. They recognised in those early days that Bournemouth must be advanced as a health resort, and that every effort must be made to secure the safety of its inhabitants and visitors. They had in Mr. James Druitt, their town clerk, Mr. Christopher Creeke, and Mr. Andrews, their engineer and surveyor, gentlemen who did not fail in their efforts to secure this end. It is due to these old servants of the town, as also to the present able and skilled borough engineer and his able coadjutors, that the borough is so well drained, and its roads and footways so perfect. Time after time has the borough enlarged its area, and the hard work of keeping up the status of the town has been never-ending. Our latest extension, the inclusion of Pokesdown, Southbourne, Winton, and Moordown has, perhaps, entailed more active supervision and care than any, but these districts have been immensely improved, and their sanitary conditions may now be considered as worthy adjuncts to the County Borough of Bournemouth.

DRAINAGE.

They are all provided with a splendid system of public sewerage, quite up-to-date, not only in perfection of construction, but also in all those adjuncts which go to make up a perfect system of public sewerage. Our automatic flushing chambers, sea-water flushing valves, road gullies, and system of sewer ventilation cannot be improved upon. There are no dead ends. All is ventilated in sections by high wrought iron shafts trapped in sections where gradients are steep, and flushed by salt water mains with flushing valves fed from tanks of 25,000 gallons capacity, in

the highest portion of the borough, and any particular portion of our system of sewers can be adequately flushed by sea water charged with appropriate disinfectants. This is, of course, of great importance in controlling and obviating risks from any of the sewers. Four flushers are regularly employed for this work. They at once detect if there is any defect or stoppage in any portion of the system, the borough engineer is at once apprised of the fact and the remedies are applied forthwith. In addition to this surface water sewers are arranged to flush the system. A special form of road catchpit, with double water seal, has supplanted the old system of large earthenware pot gullies which were found so often to become cracked by the heavy traffic, to leak, and become offensive. It is rare indeed that in Bournemouth anyone will ever notice an objectionable smell from these gullies. We invite any ratepayer, should a gully become offensive, to report to the sanitary office on a postcard, when the remedy is at once supplied.

Roads and Footpaths.

The roads and footpaths of Bournemouth may be contrasted with those of any well-ordered town in the kingdom. The cleanliness of the surface, the freedom from dust, even under motor-car traffic, cannot be complained of. But on this matter you will be able to see for yourselves in your drive round a portion of the town. It is not everyone who knows how to make a good road, but by the ability of the late Mr. Andrews, as well as that of our present engineer, this perfection in our roads is well maintained.

Gardens.

Our public gardens are very extensive, and every effort is made to make them as beautiful as possible by Mr. Stevenson, the head gardener. Every year these gardens seem to me to be more beautiful than before, and they are a perpetual delight and enjoyment to our visitors.

Parks.

In respect of parks Bournemouth is well provided. The acreage of these and the public gardens is almost one-tenth of the area of the borough. There are the Meyrick Park, Queen's Park, and King's Park. That they contribute enormously to our health interests is of course evident. They afford many facilities for physical enjoyment such as golf, bowls, cricket, football, lawn-tennis, and croquet; also enjoyment for the children, and this latter is perhaps one of the most important of all. We

do take care of our children population. Our infant mortality over a long series of years has been one of the lowest in the country.

PINE TREES.

What would Bournemouth be without its pine trees? It is true they are subjected to numberless vicissitudes, but in spite of all adverse influences the Borough is rich in the pine family—*Pinus sylvestris*, *Pinus austriaca*, *Pinus insignis*, *Araucaria*, are the particular kinds which flourish here. The authorities are fully alive to the importance of keeping up this feature of the town. Many, of course, necessarily have to be cut down for building purposes, but at all points over which the Town Council have authority thousands of trees are being and have been planted to supply the loss. I take this opportunity of giving you my opinion of the value of these kind of trees. In the winter they act as a natural wind screen, and aseptic respirator. From the peculiar nature of their foliage this can be readily understood. To maintain these features for the benefit of our successors seems to me to be wise policy, and the best legacy which we as a town can spend our energies on now. It is in the spring and summer that we reap from them the greatest advantages. For it is then that the peculiar pinus odour is most noticeable. It permeates the woods and neighbourhood, and contributes in no small degree to the health-giving influence of our climate.

CLIMATE IN SUMMER.

Our summer climate must be experienced for a course of years, and compared with that of other towns where such trees do not exist, before a complete understanding can be obtained. They help to explain the reason why the summer coolness of our town is so refreshing and bearable when compared with many other towns and seaside resorts. It is very difficult to make clear to many people who resort here in the winter months that in the summer season it is not hot here. This is one of the popular delusions bearing on our summer climate that we have to contend with. It is an erroneous idea so fixed in many minds that I feel hopeless sometimes of convincing them that my contention is right. Beyond the shade and verdant colour of our surroundings this coolness in the summer time is assisted by the absence of glare from white roads, white terraces of houses, and white cliffs. The prevailing colours in the borough are the browns and greens, the neutral tints of nature. It is to the general prevalence of these colours, and the absence of the glaring ones, that our comfort in the summer is due.

Housing.

The inhabitants of Bournemouth are all housed in good substantial houses, well built under the most stringent by-laws, and the sanitary construction of these houses is good. It is the rarest thing possible in our borough to have a case of enteric fever caused by an insanitary house. I may say that for the past twenty years this has not occurred. Cases of this complaint are exceedingly few, and the *fons et origo mali* when followed up are found to be rarely due to an insanitary house. The causes of this complaint are generally found to be without the borough boundaries.

I would say here to other municipalities that if they want to make their towns healthy, the most important consideration is to make every house throughout the district sanitary, safe, and habitable. There is no aspect of municipal hygiene which has been more strenuously striven for than this. Many years ago I inaugurated a system of sanitary certificates for houses and hotels. This has always been appreciated by our visiting population, as well as by many of the residents, and people have been educated gradually and continuously to appreciate its advantages to themselves and their families. In respect of houses of a certain value a fee is paid, and now brings in annually a very handsome amount. Last year it was over £240. The conditions required to obtain this certificate can be seen in this book of directions. All houses built in the borough have to be built in accordance with the model by-laws, but in respect of houses requiring our sanitary certificates, we do not give them unless special regulations, not contained in the by-laws, are complied with. I allude more particularly to the quality and perfectness of the sanitary fittings. In the selling or letting of a house this certificate affords a very helpful means of assurance to the purchaser or hirer of its sanitary perfection. That it has contributed to our reputation as a health resort goes without saying; and that it has helped in maintaining health and preventing disease is admitted by all.

New Buildings.

In respect of every new house, plans have to be submitted to the Building Committee. I may claim that in this borough generally there is but little conflict with architects, builders, or house speculators. In this, as in numerous other respects, the people have become educated and appreciative of right sanitary conditions. In the sanitary government of this town, the authorities avail themselves of all those Public Health Acts and Enactments which have been so frequently and persistently agitated for

in the Parliament of our country. There is here no failure to appreciate that the safety of the people is the highest duty.

INFECTIOUS DISEASES.

Our methods when dealing with infectious disease are as follows. Immediately on receipt of notification the case is isolated at our Sanitary Hospital. In a town like Bournemouth the methods of removal have to be, perhaps, somewhat different from those adopted in some other towns. The ambulances are as much like private carriages as is possible, and you may pass one in the street without distinguishing it. Then, again, we must oblige hotel proprietors, lodging-house keepers, and tradesmen, by not moving the case in the busiest part of the day. The ambulance is always sent out with a trained nurse and certain medical necessaries, hot-water tins, etc. No case of enteric is moved without the consent of the medical notifier. We have two ambulances, and these are fumigated and purified after each case. They run on indiarubber tyres of the best quality. The ambulances are usually horsed by the Fire Brigade. This insures careful driving and helps to exercise the brigade horses. The average stay in the hospital for scarlet fever cases is something over six weeks, and for cases of diphtheria until repeated investigation of swabs has proved that the patient is free from the specific germ. These two diseases are kept in separate pavilions, and special nurses attend to them. We have a capital staff of nurses, as also a most efficient matron; and porter, public disinfector, and gardener. The establishment of this hospital in 1886 was one of the best things the sanitary authorities ever completed, and its value in controlling infectious disease is most apparent. The sanitary condition of all houses from which infectious diseases have been removed is thoroughly examined, including the drainage and water supply arrangements. If any defects are found, a notice is served on the tenant or owner. Very rarely is there failure to comply with the notice sent, but in such a case a formal notice is issued by order of the Sanitary Committee, and it is but rarely that we have to resort to any punitive measures, or to take legal steps to compel. The people recognise that the suggestions made are for their good, and they proceed to do the work. The public disinfector visits the house as soon after the removal of the patient as possible, and he carries out the ordinary methods of fumigation, usually by formalin or sulphurous acid gas, and the house or room is opened the following morning. Notice is sent to the school authorities if the patient be a child attending one of the day schools in the town, and children from the same house are prevented from attending school until

such time as is safe. At our public disinfecting station we have one of the Washington Lyon's high-pressure steam disinfectors, and all infected articles are passed through it. Two vans, lined with zinc, are also used, one to remove infected articles, and the other for their return. No charge is made for this work.

In a health resort the supervision of the food supplies is important, and in my opinion can only be carried out efficiently by an officer whose experience qualifies him for such work. Scientific adulteration of various articles of food is now being carried out in such a way that even public analysts cannot definitely prove the article to be adulterated. Especially is this so with butter. In Bournemouth we have an officer whose duties embrace the supervision of all dairies, cowsheds, etc., and the inspection of all food supplies, ice cream stores, and slaughter-houses, and who acts as inspector under the Food and Drugs Act.

Dairies, Cowsheds, and Milkshops.

These places necessarily take a foremost place in the duties of any health administration. The contamination to which milk is liable, both at farm and dairy, is a matter which requires careful attention. But in rural districts where cowsheds are generally situated, it is a well known fact that the supervision of the dairy farms and cowsheds by the rural authorities is practically nil. This should not be; but what remedy have we? We cannot authoritatively inspect places outside our authorities' boundaries. We can only carry out the provisions of the Dairy and Cowsheds Orders within our own boundaries, and do what we can to make things right at home before going abroad.

In Bournemouth our food inspector not only looks after our local dairies, etc., but also by taking samples of milk delivered by the farmers to the dairymen, and having them examined bacteriologically, finds out whether the milk is clean and pure, or, in other words, free from disease germs, or whether due precautions have been taken by the farmer regarding cleanliness, etc. When samples are reported by the bacteriologist to be abnormal, or to contain matters which are foreign to pure milk, the inspector either writes warning letters to the farmer or visits the farm from which the milk came, thus securing an opportunity of noting the sanitary condition of the place. He then considers whether the authority of the district should have its attention drawn to the premises, with the view of sanitary improvements being made.

The proportion of cream is generally the point looked to by the purchaser, but it is a duty in a health resort to see that not only the quality

is good, but that the milk is pure, free from germs of disease and putrefaction, and from other elements foreign to pure milk. There are in health resorts generally a number of invalids and young children whose staple food is milk, as both invalids and children would be extremely liable to gastric disorders. I think it is incumbent, therefore, to make sure that the milk supply is not only rich but pure, but that no preservative such as boric acid can be added to milk.

SECTION 3, 1878, FOOD AND DRUGS ACT.

The inspection of the food supplies of a health resort is also important. An inspector should know the quality of all goods sold in his district by frequent inspections, and especially of such places as pie and sausage factories, ice-cream stores, fried fish shops, and the vendors of shell fish. The frequent inspection of private slaughter-houses is also important, and should include the inspection of animals and meat, and for the enforcement of the by-laws in regard to such places. In Bournemouth, I am sorry to say, we have not yet a public abattoir where the animals might be killed, dressed, and kept in the best sanitary surroundings, and where all carcases of pigs, sheep, and oxen, which have been slaughtered outside our Borough, should be brought for inspection.

FOOD AND DRUGS ACTS.

Regarding the work under these Acts, I think the most important, from a health standpoint, is the work which the inspector carries out in procuring samples of articles which may contain preservatives or metals in excess, or may be injurious to health. It is in such matters that an efficient inspector can show his value in procuring such articles as peas, polonies, sausages, jams, non-alcoholic drinks, etc., all of which are very liable to contain boric or salicylic acid, and cream of tartar, and tartaric acid, lemonade, and other powders which often contain lead. Then preserved peas have to be watched for copper sulphate. All such articles are very liable to cause injurious effects to the consumer, if they contain a preservative or a metal, but it is these very articles which are so extensively used by the visitor and holiday-maker in health resorts. By the purchasing of such articles at intervals a great improvement can be brought about, more care being exercised in the manufacture of the articles once a warning letter has been sent, or a prosecution taken place. To mention only one article, fresh sausages, the samples purchased in 1905 show a great reduction in the amount of boric acid used from the samples taken in 1903, and in some shops the use of boric acid has been discontinued since the 1903 warning was given.

Disposal of the Dead.

The right disposal of the dead is not yet in a satisfactory condition, and although our subsoil of gravel and sand is favourable for the ordinary method, the much more sanitary method by cremation is not yet established. I have for many years been strongly advocating this method, and if we still wish to be quite in the forefront of towns with a reputation, it must be adopted, and the sooner the better. One notices that public opinion is decidedly moving in this direction.

Bacteriology.

I venture to assert that the prosperity of Bournemouth and its foremost position as a health resort, is due in no small measure to the organisation, energy, and progressive policy of its Municipal Sanitary Department. As practical sanitarians we are ever ready to make use of any scientific discovery, or hygienic advance that may be beneficial to the health and welfare of our community. The science of bacteriology may be taken as a conspicuous example. During recent years bacteriology has done great service (1) in clearing up the obscure nature of certain diseases (2) in showing how these diseases may be spread, controlled, and exterminated, and (3) in establishing many facts of vital importance to the pioneers of preventive medicine, &c., &c. This Municipality was amongst the first to recognise the value of bacteriological investigations, and for the past seven years bacteriological work has been systematically and thoroughly carried out in the Borough. I may mention that during the past year no less than 449 bacteriological examinations were made. They included:—

(*a*) Milk samples, *re* tuberculosis, excess of bacteria, etc.
(*b*) Throat swabs from diphtheric patients, and cases of doubtful throat disorders.
(*c*) Blood, *re* enteric, malaria, anthrax, etc.
(*d*) Oysters, *re* enteric, and sewage pollution.
(*e*) Ice creams, *re* sundry bacterial contaminations etc.

In all that concerns this branch of science, as applied to public health, we claim to be well up to date, and fully prepared for all emergencies.

In the very early days we had only one inspector; to-day we have a public analyst, a bacteriologist, and seven inspectors (six permanent and one temporary), also an inspector under the Food and Drugs Acts; two clerks in the office, four flushers, four drain testers, and other necessary helpers.

ALDERMAN BEALE (Bournemouth) said Dr. Nunn had put before them a very exhaustive paper. He was not sure that they deserved to be so lauded, but it had always been the aim of the borough to keep the town up to a high sanitary point. The important question of cremation had lately been before them in a severe form, and although the committee had agreed that it was necessary in some future time, they recognised that they had to study economy and consider facts as to cost, that now prevented them doing as they wished.

DR. J. GROVES (Isle of Wight) said that what struck him chiefly was that the bulk of the paper referred to what every citizen had a perfect right to expect whether he were in a health resort or any other place. But the administrators in a health resort had to provide something beyond what other towns had to; an environment which would take their nervous and physically sick visitors out of themselves, indeed, anything and everything which was likely to help them forward. Visitors, too, often brought with them the germs of infectious disease, and so whilst everything possible was done for such visitors, an eye must be kept on them in order to prevent the spread of disease. Everybody had a right to demand the sanitary conditions which the law prescribed, but in a health resort something more was required; and the sentiments of hospitality and of honour obliged them to do for their visitors perhaps what they did not do for themselves. In a properly administered place, they ought to have a water supply absolutely above suspicion. They ought not to trust to chemical or bacteriological tests, the only true test being the sanitary test, which insured the impossibility of the water becoming contaminated. Turning to Dr. Nunn's remarks about the training of children in hygiene, the speaker said the training of the teacher came first, for the teachers in the public elementary schools of the country were as ignorant as they could be about the laws of health, and we could not advance in education until we had trained men and women to teach. They should go to Japan or Germany for standards of what they should do in respect of vaccination and other things. In England we ran after spectres all the time. He was glad that at Bournemouth they had got over the great trouble of motor dust which was afflicting the whole country, and was so dangerous where there were phthisical patients. They had apparently done everything they could to keep their houses wholesome, according to Dr. Nunn, but one thing he could not understand was the granting of sanitary certificates. It ought not to be necessary to grant a sanitary certificate to any house, it being the business of the authority to see that every house was sanitary, and that they had a sufficient number of inspectors to do the inspecting work. And yet Dr. Nunn told them that the Bournemouth authority took £250 for those certificates. Then they were told of charges for disinfecting houses. Did they really mean to say that they charged anybody who had the misfortune of sickness in his house? The community had to pay for their protection, not the individual. He observed that notices were sent by

the sanitary department to the school authorities; but surely the school authorities had their attendance officer, who ought to give information where there was the slightest suspicion of a child suffering from any infectious disease? With regard to milk supply, it was certain the sanitary authority ought to have some sort of control over the milk from almost before it left the cow until it was in the mouth of the consumer. Milk was collected in a most scandalous manner both in town and country, and if the people saw the milk collected, the majority of them would not drink it.

Dr. Barclay (Weymouth) said in sanitary administration, whether in a health resort or any other place, they must strive for the ideal; and, as the education of the great mass of the adult population was most difficult to achieve, they must educate the young in the principles of hygiene, personal and domestic, and sanitary administration. It was true that the teachers were not at present thoroughly competent to give this theoretical instruction, and in the emergency some authorities had appointed education medical officers, who had started taking some steps in the instruction of the public. The Weymouth Council had appointed him and his predecessor education medical officers, and within the last few months had placed the school attendance officer under the direction of the medical officer of health, by which means the sanitary authority had a grip from the origin of those diseases that originated in schools and spread by schools. With regard to water supply, the speaker strongly favoured municipalisation wherever possible as calculated to ensure the best results, and said he agreed that there should be no necessity for water analyses, if the source of the supply was beyond doubt, which it would never be with a company. It was only a municipality that could afford to buy up farms, houses, and everything else within the watershed, and make sure that the source was beyond the possibility of contamination. There would be no necessity then for examinations, or for those abominations, household filters, but they would have the water clear from its source. The speaker expressed his disapproval of the tall shafts, which pour pollution out into the air; and, he emphasised the seriousness of the dust problem, and said the man who invented a cure for dust ought to make his fortune. With regard to overcrowding, Dr. Barclay pointed out that the question was of the greatest importance in a health resort, where during the season the visitors were trebled or quadrupled, and said the ideal they should strive for was that every house let in lodgings should be subject to inspection. Whilst in Lancashire health resorts, he had known bath-rooms used for months as bedrooms, whilst servants had month after month slept in the scullery. He knew that not as an official but as a visitor, and such things ought not to be. With respect to new buildings, Dr. Barclay mentioned that at Weymouth the sanitary authority had granted his request that the plans of all new buildings, besides being passed by the surveyor and building inspector, should be submitted to him as medical officer before they went to the committee; and described the

Dairies and Cowsheds Order as an absolute dead letter in the majority of the rural districts.

DR. G. M. HIRONS (Bournemouth) said he was glad the Bournemouth Corporation had secured the softening of the water, and mentioned that he was instrumental in getting the clause inserted in the Act of Parliament which gave the Corporation power to call upon the Water Company to soften the water. He did not agree with previous speakers as to the non-necessity for analyses or examination of water supposing the supply was municipally owned, simply because the source was known to be pure. He hoped the establishment of a municipal slaughter-house in Bournemouth would be only a matter of time. With regard to vaccination, it was either right or wrong, and if right it should be thoroughly enforced.

DR. JOHNSON SMYTH (Bournemouth) spoke about the dangers of dust dissemination in promoting all kinds of throat and chest diseases, and described the means whereby in Bournemouth they had reduced the dangers to a minimum. As regarded the question of Sunday repose, he said he was not a very keen Sabbatarian. Bournemouth was a town where men who lived strenuous lives came spent and worn, and they found in Bournemouth just the rest they needed. They found Sunday repose, and an environment and other conditions which contributed to the unbending of the bow. And a health resort that could supply that to those who sought repose and rest was to be proud of. If they began to make Bournemouth like Blackpool or Paris they would lower the standard and value of their health resort, and would regret it most thoroughly.

MR. HENRY NEWLYN, J.P. (Bournemouth), on the subject of water supply, said in all his experience as a public caterer he had never heard a single reflection on the water supply previous to the softening process. He was not a chemist, and could not tell what the benefit of the softening would be. He only hoped it would do what was anticipated—the ratepayers, in any case, would have to pay for it.

DR. ALDERSON, J.P. (Bournemouth), spoke strongly on the granting of vaccination exemption certificates, and said that a woman applied for one, and got it, at a place not far from Bournemouth. He was on the Bench, and asked her: "Are you sure you are doing right in having this certificate?" She did not take the certificate, but had the child vaccinated. On his mentioning this to one of his colleagues on the Bench, he replied: "You exceeded your duty, and if you do it again I shall say something different." These certificates, he said, were granted by people who knew nothing about the subject, only for the sake of doing a kindness, and thus rendered the Vaccination Act futile.

Councillor Hawkes (Bournemouth) said, as a member both of the sanitary and the building committee he had been struck by an anomaly in practice at Bournemouth, which seemed without justification. A person might erect a house, and on completion secure the certificate of the building inspector that it had been erected in compliance with the by-laws (the drainage system would have been tested and the sanitary fittings approved) yet possibly within six months from this satisfactory completion the owner, desiring a certificate by the medical officer of health that the house complied with his standard of sanitation, might first be required to replace the fittings by other makers, and otherwise expend monies to a very considerable amount. These different standards should cease, and both building and sanitary regulations be brought into accord. On the building committee he had noticed that plans for new houses usually provided the living rooms of good height in residential houses, and that they were to be well ventilated, and to be finished on sound hygienic principles, but the kitchen, scullery and offices, where health dangers lurked, received scant attention, considered from this standpoint. In his view the scullery especially should be built with walls of glazed brick, floors tiled or smooth faced cement, and ceiling of impervious material. No shelving or other fixtures should be attached close up to the walls, and the former should be made of movable battens with intervening spaces between the parts. In fact, it should be possible in a scullery to clean with a hose pipe.

NOTES FROM THE REPORTS OF THE MEDICAL OFFICERS OF HEALTH.

Extracts from the Report of the Medical Officer of Health for the West Riding County Council for 1904, James Robert Kaye, M.B., C.M. D.P.H., F.C.S.

THE MIDWIVES REGISTRATION ACT OF 1902.

The Midwives Act of 1902 has introduced an entirely new branch of work, and one which is full of possibilities in its bearing on infant mortality and kindred problems. The West Riding Sanitary Committee becomes the Local Supervising Authority for the whole of the Administrative County, and is charged with the supervision of the practice of midwives within that extensive area. The total number of enrolled midwives resident in the Administrative County is 1088. Of these 972 or 89·3 per cent. have been admitted to the roll on the ground of having, for one year previous to the passing of this Act, been in *bona fide* practice as midwives. This qualification affords very little proof of adequate knowledge and skill, and it is a fact that quite a number are illiterates. Nevertheless, the services of untrained midwives are at present indispensable, and it will be a work requiring a great deal of time and no little tact and patience to bring this body of women into line with the Rules and Regulations issued by the Central Midwives Board. These rules provide the basis on which the County Council's work of supervision has to rest, and therefore the first essential is that they should be thoroughly understood by the midwives. During 1904 a copy of the rules was supplied gratis to every woman who gave notice of her intention to practise in the West Riding; and I have endeavoured on all possible occasions to elucidate and simplify their meaning. The necessity for this becomes apparent when it is stated that in order to draw a midwife's attention to her duty in regard to a feeble premature child, for instance, one has to refer her to "*Sec. E, Rule* 17 *c*, (*II.*) (6)," and when she gets there she has to go back some 400 words to find the key which makes sense of the regulation and which tells her that in such cases she must decline to attend alone and must advise that a doctor be sent for. The Committee has recently made provision which will enable the Health Department to undertake the visitation of midwives in a more systematic manner than has hitherto been possible, and in that way I hope not only to supervise the literal carrying out of the Statutory Rules, but also to implant, where needed, some little enlightenment on the care of parturient women and infants, and the importance of proper feeding, clothing, and cleanliness. I have not yet found it necessary to formally report any midwife for a

breach of the rules, because all such as have been noted so far have been mere technical omissions or delays due to lack of thorough acquaintance with the new rules, which in many points require personal explanation. The following records for 1904 are necessarily meagre, seeing that the great majority of the midwives delayed their registration as long as possible and did not come on to the roll until April, 1905.

Notifications of Intention to Practise received during 1904	176*
" Sending for Medical Aid by Midwife	6
" Death of Mother or Child	3
" Still Births	8

* The present figure is now close upon 600.

ENTERIC FEVER.

This disease was notified to the extent of 1,225 cases during 1904, as compared with 1,210 in the previous year, the number of deaths being 237 in 1904 and 195 in 1903. There was no special prevalence of the disease until the month of September when a serious epidemic occurred at Denaby Main and New Conisborough in the Doncaster Rural District, and in October there were also local prevalences at Batley and Rothwell. The outbreak at Denaby Main and New Conisborough was investigated at the time by the Local Medical Officer of Health and myself, and also became the subject of an exhaustive enquiry by Dr. Farrar for the Local Government Board. The water supply and milk supply were, after careful scrutiny, exonerated from any share in the mischief, and the conclusion arrived at was that the privy middens of the locality had become infected by the excreta of patients being deposited therein before the nature of the disease was recognised. It is well known that the typhoid infection can retain its virulence in such surroundings and is capable of being carried in various ways to the adjoining houses—possibly by being deposited on food by the hosts of flies which breed on these middens and seek their food in the houses

A very similar story is told in the Rothwell report by Dr. Stevenson as follows:—" One of the first cases notified was being treated in the kitchen where the food was cooked and the meals taken. The privy ashpit used by this family and into which the excreta from the patient was emptied, was situated in a yard surrounded by dwelling-houses and distant from them only a few feet, and was used by all the people living in the yard. The patient was being nursed and attended to by members of the household and neighbours. No fewer than 23 cases out of the 44 notified were directly traceable to the cases above mentioned. The epidemic was of a very malignant type, and several families had become infected before any sanitary precautions had been taken. Immediately after notification nearly all the patients were removed to the Isolation Hospital and every means taken to prevent the spread of the disease, and the result was that the epidemic was confined to the centres originally involved."

SCHOOLS.

The close connection between the health of the school community and that of a district generally is too obvious to need pointing out, but the problem of the hygienic control of schools is a most difficult one, which is frequently commented on in the reports under review. Record is made of the special closure of 270 schools in the West Riding, on account of infectious sickness during 1904, and it is added that this measure has not always proved effective. Dr. White, of Dodworth, remarks that, "schools afford exceptional facilities for spreading infectious diseases. In no other circumstances do children sit side by side for six hours a day, and five days a week in a closed room, the air vitiated and infected by emanations from inmates possibly convalescent from infectious disease, and by catching discharges from ears, nose and throat, the scholars directly spreading the germs of disease by coughing and sneezing, or by exchanging slates, handkerchiefs, pencils and knives."

In discussing the question of the admission of children to public elementary schools at the age of three years, Dr. Mackenzie writes in his Altofts report:—"Although there is a good deal of measles after the age of five years, we know that the incidence of attacks is highest during the third, fourth and fifth year of life, and nearly all the mortality is under five years (all the deaths in Altofts during the year were under five), so that if a child got safely past the age of five, there is strength enough to enable it, as a rule, to pass safely through measles when attacked. Infants under five years are encouraged by the Education Acts to attend school, as a Government Grant is paid for them, and the great majority of mothers are only too pleased to get them out of the way at home, while teachers are encouraged to unnaturally cram these poor children. It is a law of nature that organisms which bloom early, suffer from deficient vitality and fade early, and yet our Education laws ignore this, children are unnaturally forced, and the result will be mental and physical degeneration. When measles breaks out the early symptoms are those of a common cold, they are overlooked, the sufferers go to school where others contract the disease, and go home to sicken, and too often to die."

Dr. Sproull, in the Luddendenfoot report, says:—"It looks as if the Infants' Departments of schools are being turned into nurseries, considering the tender age at which some children are sent there; yet, if the mother dares to keep the child from school, owing to a slight ailment, or unfavourable weather, she is quickly called upon to state her reasons, or provide a medical certificate."

Dr. Scatterty, of Keighley, writes on the same subject as follows:—"It may be objected that children of three and five years of age are better in school than running wild in the streets or tumbling over each other in crowded dwellings. In reply, we note that 90 children under five died in three months from infection contracted in the school, whereas the older children were practically exempt. Even if the epidemic was exceptionally severe, our duty as a Sanitary Authority

should rather be to prevent the overcrowding referred to, and provide spaces where children may enjoy out of doors the fresh air and freedom which they cannot get in any school in the land, and where, if they must be taught, they could have lessons on nasal breathing, health exercises, &c., to fit them for the indoor school life that is to follow. Now that the State has united in holy bonds the Sanitary and the Education Authority, let us not in our schools divorce the *sana mens* from the *sana corpora* of our children. I have no hesitation in saying that personally, and as your Medical Officer of Health, I should be satisfied if the first and only lesson learned by children during their first year of school life was the new commandment 'Thou shalt be clean, and shalt breathe through thy nostrils.'"

Extracts from the Report of the Medical Officer of Health for the Metropolitan Borough of Stoke Newington for 1904,
HENRY KENWOOD, M.B., L.R.C.P., D.P.H., F.C.S.

W.C. ACCOMMODATION IN TENEMENT HOUSES.

The requirement of the bye-law made by the London County Council under the Public Health (London) Act of 1891, that water-closet accommodation must be provided in the proportion of one water-closet to every twelve persons, is by no means an easy one to enforce in all cases. Conditions of tenancy vary so frequently in these houses, that it is often difficult and unreasonable to enforce the bye-law. What is really required is a bye-law requiring that in all cases where more than two families are housed under one roof there should be more than one water-closet, and there should be provided a separate sink and a separate draw-off tap for drinking-water for each family so housed.

MEASLES AND EDUCATION.

Measles is most fatal at about three or four years of age, and every year during which one can postpone the attack is very much in favour of the child. The loss to education would be practically *nil.* A child under five is certainly too young to benefit from almost any conceivable scheme of education. The large amount of money spent on the so-called "education" of babies under five in elementary schools could be put to a far better purpose by applying it to the needs of higher education and the periodical medical examination of the scholars.

Volume XXVII. No. 7. Issued August, 1906.

JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

DISCUSSION ON

THE PROVISION OF A PURE MILK SUPPLY.

Opened by S. BARWISE, M.D., B.Sc.,
County Medical Officer of Health, Derbyshire.
(FELLOW.)

And JOHN WHITE, F.I.C.,
Public Analyst for the County of Derby.

Read at Sessional Meeting, Derby, June 29th, 1906.

THE rapid growth of the large towns during the last fifty years has indirectly resulted in the establishment of an enormous industry in providing the inhabitants of these towns with milk. Prior to 1860, the milk trade, as it is known to-day, was not in existence. Each community depended for its milk upon the cows in its immediate vicinity, but with the establishment of railways it not only became possible but necessary for the urban districts to obtain their milk from a distance. The purity of the milk supplied in the urban districts to-day depends, therefore, upon the manner in which rural authorities at a distance enforce the law.

From time to time outbreaks of scarlet fever, diphtheria, and enteric fever have occurred, owing to infective material having gained access to milk at a distance from the localities affected. It is on this account that Clause 4 was inserted in the Infectious Diseases Prevention Act, enabling the officers of one authority to inspect the dairies within the district of another, and under certain conditions to cause the dairyman to appear before the authority to show cause why an order should not be made preventing him from supplying milk within their district.

Similar power has also been obtained by a large number of corporations, enabling them to obtain samples of milk from any particular cow

outside their district where their medical officer has reported that he is of opinion that such milk is likely to cause tuberculosis. Three or four weeks must elapse, however, between the taking of samples and the results of the bacteriological examinations, by which time it frequently happens that the cow yielding the milk has been sold.

Again, as Houston, Delepine, Newman and others have proved, excretal organisms and dirt are usually present in milk as supplied in the large towns.

It is evident that, under existing circumstances, the public is inadequately protected, and various proposals for the more effective control of the milk supply have from time to time been made.

Bacterial standards of purity have been advocated; for instance, that no tubercle bacilli should be present, nor excretal organisms in a definite quantity. It has also been suggested that there should be a numerical standard for all bacteria in milk.

Except as regards tubercle bacilli, the enforcement of such standards is impracticable, and even if adopted, in spite of the enormous attendant difficulties, would be useless for dealing with such an infection as scarlet fever.

Some are boldly advocating the municipalization of the milk supplies, while others are adopting a policy of despair, and insist that all milk must be boiled, or at any rate, pasteurized. Several corporations have instituted sterilized milk depots, and it has recently been urged that this course is not sufficient, but that the local authority should also own the cows, and it will probably not be long before owning the farms also will have its champions.

No less an authority than Sir Douglas Powell writes:—

> "There can be no doubt that scientifically conducted dairy farms, on a large scale with urban depots for the reception and dispensing of pure milk in clean bottles at a fair price to the poor, would pay, and would be a most laudable employment of the municipal enterprise that is often devoted to matters of much less urgent public interest and importance."

The ratepayers of Liverpool are finding as much as £2,000 a year out of the rates for providing sterilized milk for the children of Liverpool. We are not suggesting that this is unnecessary or inadvisable. It is a short cut, but it does not go to the root of the matter.

As far as tubercle in milk is concerned powers should be obtained to prevent the sale of cows certified by a veterinary surgeon as under suspicion. When the bacteriological test shows the suspicion to be proved the cow should be branded, fed up, and only sold for slaughter.

Leaving the question of tuberculosis and devoting our attention exclusively to the question of the provision of a clean milk supply, this

paper endeavours to point out what is believed to be a practical and moderate course; one which will enable the consumers in the big towns to feel assured that every reasonable precaution is taken against the contamination of the milk, and at the same time the conditions imposed upon the producer are not beyond what he can be expected to comply with without reducing his margin of profit.

Milk, as it is secreted in the udder of the cow, is a sterile fluid. It may be contaminated by the fore-milk remaining in the teats of the cow, and it is liable to contamination at any moment during its passage from the cow until it reaches the consumer.

A dairy is usually associated in the public mind with all that is clean, cool, and spotless; but to those who have been trained in asepticism, whether as bacteriologists or medical men, it is palpably impossible to procure, under present conditions, an aseptic fluid in a cowshed. The cowsheds as a rule have insufficient light. The cows are not groomed. Their udders are rarely washed, and it is seldom that you hear of the hair being cut from them. The most casual observer must have noticed the dirt which is frequently to be seen at the bottom of a milk jug.

> "To watch the milking of cows is to watch a process of unscientific inoculation of a pure (or almost pure) medium with unknown quantities of unspecified germs . . . . Whoever knows the meaning of aseptic surgery must feel his blood run cold when he watches, even in imagination, the thousand chances of germ inoculation. From cow to cow the milker goes, taking with her or him the stale epithelium of the last cow, the particles of dirt caught from the floor, the hairs, the dust, and the germs that adhere to them . . . . Everywhere throughout the whole process of milking, the perishable superbly nutrient liquid receives its repeated sowings of germinal and non-germinal dirt. And this in good dairies. What must it be where cows are never groomed, where hands are only by accident, if at all, washed, where heads are only occasionally cleaned, where spittings (tobacco or other) are not infrequent."

The foregoing is a quotation from the medical member of the Local Government Board of Scotland, Dr. Mackenzie.

Any attempt to alter the present condition of affairs would seem hopeless, if it were not a fact that in other countries less conservative than ours, things are not in the same lamentable condition.

The question of the origin of the bacterial impurities in milk which give rise to infantile diarrhœa, has been made the subject of careful investigations, but there is no general agreement on the point. We are of opinion that infection takes place at the farm during the winter months, and in transit to the dairyman's, and in the consumers' houses during the summer.

An investigation recently made by us as to the condition in which milk was delivered from farms to a large wholesale dealer when the cows were up and when they were out at grass confirms this view. The farms supplying milk were selected farms, where more than the average standard of cleanliness was complied with, the farms being inspected at least once a fortnight, and the milk supplied being systematically analyzed. Altogether the milk from twenty different farms was examined. The quantity of dirt which was arrested on a fine gauze, 100 strands to the inch, was estimated. That the straining was only such as would have been possible for the farmer himself to have carried out will be evident from the fact that it took place at the rate of a gallon in two seconds. The dirt which came from 78 gallons of milk supplied by one farmer we have kept between two plates of glass. It consists of the hair of cows, particles of dung, flies, straw and hay, starch from some cereal, and in this instance, a snail and a woodlouse. One sample contained *caseous material*, which might be *caseous pus*, but this we do not vouch for. The average proportion of dirt worked out as four times as much in the winter when the cows are kept up, as in the summer when they are out at grass. This solid residue upon chemical analysis yielded only 10 per cent. of mineral matter, showing that the dirt was almost entirely of organic origin. These conclusions are based upon the examination of over 1,100 gallons of milk.

If milk supplied to a large dealer, who has an efficient inspecting staff, and who systematically submits the milk to analysis, is of the character shown, what can the milk be which is supplied by the small dealer in the slums of our large towns?

The question arises, What can be done to remedy the present state of affairs?

In the first place, dealing with the farm buildings, the Dairies, Cowsheds, and Milkshops Orders should be systematically enforced. Where a district council refuses to enforce these orders, the county council should be empowered to step in and enforce them at the expense of the district council. But the orders require strengthening by making it compulsory for milk to be strained through a standard strainer, and an offence for it to contain visible dirt.

Reform all along the line is required, and the first condition which calls for drastic treatment is the removal of the manure heap from the centre of the farmyard, where it is frequently in close proximity to a surface well. If the farm is an old one, and it is impossible to move the manure pit, it should be at any rate railed off. The manure should be

removed from the cowshed *after* milking in the morning, and at least an hour before milking in the evening.

The provision of a proper place for the milker to wash his hands, with a supply of clean towels, a washable overall, and cap should be obligatory, and these should be washed once a week.

The cows should be taken from the cowshed and groomed each day. To groom the cow in the cowshed would be to make things worse than they are at present.

At the opening of the Yoxall Co-operative Dairy Company, Lord Burton called attention to the necessity for cleanliness both in the factory and in connection with the housing of the cows, because "this was one of the greatest elements to success." This was done in Scotland to a very great extent, where, said Lord Burton, *the people groomed their cows and kept them in as good condition as their horses.*

Why a horse should be groomed and sponged down, while a cow should be allowed to remain caked up in its own dung, is incomprehensible. When once the cows are clean, it would not be difficult to keep them so. All hairs about the udders likely to become covered with dirt should be cut off, and the udders cleaned before milking.

There is a clause in the milk contracts of the Manchester Corporation that the udders of the cows shall be carefully cleansed before milking, and this condition should be universal in all milk contracts.

Finally, the milk should be strained through an efficient strainer of fine gauze, covered with Mull muslin with 120 fibres to the lineal inch, or a disc of cotton wool as used in the Ulax strainer. The wire strainer to be of practical use must have at least 100 strands to the inch, and the area must be sufficiently large to permit of a gallon being filtered in a quarter of a minute. The strainer should be used in connection with the refrigerator so that straining may take place at the same time as refrigeration. The milk should be cooled down to 56° F.

The authors of this paper were instructed by the Derbyshire County Council to report upon the various milk strainers on the market, with a view of making a recommendation to the Derbyshire farmers. A difficulty was experienced at the outset owing to there being no apparatus for testing the efficiency of strainers. They were compelled to devise an apparatus which they now show. Tested with this apparatus it is clear that no gauze strainer alone is sufficient.

The results of tests of milk before and after going through the following strainers are given :—

1. The ordinary wire strainers on the market.
2. A special strainer of fine gauze, 100 strands to the inch.
3. The same with an addition of a layer of Mull muslin 120 fibres to the lineal inch.
4. The Ulax strainer, and other filters using cotton wool.
5. Ordinary filter paper.

It was found that filter paper was absolutely too slow, and in addition arrested a large proportion of the cream, and that the Ulax strainer was the next slowest. We are of opinion, however, that the rate of filtration with this filter can be easily increased by having a coarse gauze half an inch above the layer of cotton wool to arrest the coarser suspended matters. The fine gauze covered with Mull muslin, filtered a litre in five seconds, through an area of 4·9 inches, so that by increasing this area it is evident that a practicable filter can be made. The ordinary strainers on the market filter at an even greater rate, but allow the dirt to pass.

We venture to suggest that milk strainers should be stamped by the County Councils and County Borough Councils, just as weights and measures are, and that no strainer should be allowed on the market which permits dirt to go through, which can be arrested on a standard strainer of gauze 100 strands to the inch, covered with a layer of muslin of 120 fibres to the inch.

To prove whether milk had been passed through such a strainer, it would merely be necessary to test it on a standard apparatus, such as we have devised. The dirt which was collected could be taken into Court, and whether the magistrates convicted or not would be left entirely to their discretion. The apparatus which we show enables the whole of the dirt to be collected on a white surface, so that the quantity can be estimated if necessary, the number of particles counted, its nature investigated in detail, and the deposit preserved for future reference and comparison.

Prevention is better than cure, and it is obvious that milk, treated as indicated above, would contain much less original contamination, than under the present conditions. The importance of this becomes apparent when we consider the rate at which organisms multiply, and the fact that most organisms, if not all, must have some particulate matter to settle upon.

As Dr. Newman has pointed out, organisms comply most accurately with Tyndall's raft theory; the process of straining, separating the rafts, would remove the great bulk of the bacteria.

Milk collected under the best conditions contains a few thousand

organisms per cc. If kept twenty-four hours at 55° this number will probably increase six-fold. On the other hand the bacteria in the same milk if kept for twenty-four hours at 60° would increase thirty to sixty-fold. So important is the question of refrigeration that in New York for a milk-dealer to have milk in his possession at a higher temperature than 40° is an offence, the milk being, *ipso facto*, regarded as adulterated.

The milk having been obtained from groomed cows, milked by clean milkers, strained through a proper strainer, and immediately refrigerated. is put into the churns for transmission by rail, and here we take exception to a form of churn which is too commonly met with, namely the churn with the funnel-shaped neck. This arrangement exposes a maximum amount of surface to the dust and the rain. It is almost necessary for anyone handling the churn to put his fingers on a part of it over which the milk is to flow. The can, if full, when turned on its side allows the milk to flow on to the top of the lid, washing the dirt off the lid and swilling the hand of the person rolling the can along. When the can is put in the upright position again, the milk flows back into the can. The best type of lid is the one with a convex surface overlapping the can so that any external dirt is removed with the lid.

The cans should all be sealed with the stamp of the farmer. If the railway company open the can it should immediately be sealed with their seal, so that the milk-dealer may know that it has not been tampered with by some unauthorised person.

The railway companies should be compelled to provide special trucks for the cans. Indeed, where there is much milk traffic, the big companies such as the Midland, London and North Western, Great Western, do provide special trucks, but they are not washed with anything like sufficient frequency. Possibly, owing to competition, the prices paid for the transmission are so low as not to permit of much cleanliness, but this is a point upon which we ought to insist upon more being done. The milk vans should be lime-washed inside, and the roofs should also be lime-washed, to reflect the heat. They should also be adequately and properly ventilated. Cool sheds should be provided at the railway stations where the milk can be stored until its departure, and in summer some means should be provided for refrigerating or keeping the vans cool.

With regard to the milk when it gets to the dealers, we find that some of the larger firms pass the whole of the milk through a separator and centrifugalize it, the cream and milk coming over through one tube. This process has the result of separating practically all the dirt, and under present circumstances it appears a wise precaution for dealers to take.

1. The ordinary wire st . . ources of contamination in the houses of
2. A special strainer of . . rever, two important points which must be
3. The same with a . . mics of autumnal diarrhœa occur when the
fibres to the li . . n is cleanest; secondly, both rich and poor
4. The Ulax strain . . lied with milk from the same source, yet
5. Ordinary filter . . . autumnal diarrhœa.

It was found that filter . . sanitary authorities of the large towns that
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The above block shows the Barwise apparatus for estimation of dirt, as . . . Davis of Derby.

The cylinder, holding a litre, is filled from below: the sieves are fixed . . . then inverted, the screw at the top being loosened to let in air.

The block shows the two sieves taken out, with the dirt arrested on the . . . surface.

DR. W. J. HOWARTH (Derby) expressed his pleasure that this question of a pure milk supply had been introduced by two officials of the County Council, especially so as Derbyshire was a dairying county. He considered that there was a greater probability of reforms resulting from action by the county councils than by the boroughs. He drew attention to the difficulties which stood in the way of any very great advantages being derived from the model clauses which were obtained by Derby in the session of 1899 for the prevention of the spread of tuberculosis through the agency of milk. The medical officer of health was not empowered to inspect any farm in an outside district until he had reasonable grounds for supposing that the milk which was supplied from a farm was liable to cause tuberculosis in persons consuming it. He could rarely arrive at such a conclusion except by actual knowledge that the milk possessed infective qualities. That necessitated a bacteriological examination of milk being made, and as samples had to be taken with special precautions, no doubt was left in the milk-seller's mind as to the nature of the enquiry, with the result that when a positive opinion was received from the bacteriologist, there was very frequently considerable difficulty in finding the animal or animals which had imparted this quality to the milk.

No case of suspicious, or actual, tubercle of the udder had been reported to him, as medical officer of health, since the clauses came into operation. He suggested that additional executive powers should be given to the county councils which would enable them to appoint inspectors, whose duties, in part, would be to make systematic visits to all cowsheds in which dairy cattle were herded, power being given to such inspectors to exclude from the supply the milk of any cow which had a suspicious udder, pending an examination of the milk of that cow. In the event of the suspicion proving to be unfounded, adequate compensation would be paid for the exclusion of the milk, but if a positive result was obtained, the animal might be slaughtered under supervision, and passed or not as the case might require for human consumption.

He also approved of the suggestion that in case of default by a rural authority the Dairies, Cowsheds, and Milkshops Orders should be carried out by the county council. With reference to filtration of milk, whilst approving of such as an additional preventive, he thought that pressure should be brought to bear upon those responsible to require improvements of buildings, surroundings and methods, with the object of lessening the possibilities of impurities gaining access, and that that should be the chief object. To that should be added the enforced chilling of milk before distribution. He suggested that one, and perhaps the main reason why more farmers did not at the present time chill the milk, particularly if it was only for local distribution, was that the process prevented cream rising so easily to the top as it did in milk that had not been chilled, and that the average house-wife suspected that the apparent deficiency of the creamy layer after standing was due to the extraction of cream rather than to results of the chilling process.

MR. E. DOMMEN (Nestlé and Anglo-Swiss Condensed Milk Co.) said, as a stranger, he should like to make a few personal remarks on the milk supply to towns in this country, as compared to those of a few continental countries. One was surprised at the huge proportions of this fresh milk traffic, run almost exclusively on mercantile lines, without sufficient attention to the sanitary and scientific part of the business. To judge from some of the cans employed and the state of railway vans conveying the milk, it seemed that too little precaution was taken to ensure the clean surrounding necessary to the milk. The railway rates for conveying milk for distances exceeding sometimes 150 miles were were very low, and he was not sure if this was not often the reason for railway companies neglecting the cleanliness of their milk vans. The standard size of milk cans, seventeen gallons, was not very satisfactory for cleaning purposes as they were too deep to allow a careful hand brushing. They answered the purpose of the railway companies very well, being easy to roll on platforms, but for manipulation at the farms they were too heavy when full. The lids were no better, as pointed out already; they did not prevent, but even facilitated the access of dust and rain into the cans. The only rational lid was the one overlapping the top rim and having a convex form to drain the dust and rain over the outside of the can.

DR. H. SCURFIELD (Sheffield) agreed with previous speakers who did not consider sterilized milk an ideal thing. Where possible he considered the best thing to aim at was the delivery of milk from healthy cows in bottles which had been properly cooled immediately after being taken from the cows. Even with a supply of well water it was necessary to use ice in the hot months for the purpose of securing adequate cooling. The farmers who supplied the Copenhagen Milk Company all had to keep a supply of ice, and each one had his ice house. The ice house was filled at the end of winter and the supply lasted through the summer. Perhaps the same could be done in England without great cost.

In order to meet additional expense caused by cooling, etc., he thought more attention should be given by the dairy farmers to keeping exact records of the milk and butter fat given by each cow, and to the weeding out of unprofitable cows. Mr. John Speir of Newton Farm, Glasgow, in a paper read before the Highland and Agricultural Society of Scotland, had given some interesting results of the work of the Milk Record Societies in Scotland and elsewhere. Mr. Speir gave an example of a society in the case of which the surplus per cow after paying the cost of food was: for 1901, 43s. 8d.; 1902, 71s. 9d.; 1903, 103s. 10s. Mr. Speir also gave examples of herds where the value of the milk given by individual cows varied from over £30 to under £10. The other point to which he wished to refer was also one to which Mr. John Speir had drawn attention in a paper on "The Best Means of Housing Cows." Mr. Speir had pointed out that if cowsheds are freely

ventilated in the early autumn the temperature is kept low, and the stock will in consequence gradually assume a longer and a more compact coat than they had in summer, and that with such animals the milk does not shrink to an appreciable extent when the temperature of the cowsheds is lowered to 40° F., or even 35° F., and that cows kept under such circumstances are much less liable to chills or mammitis. His reason for mentioning this was that if the cowsheds were freely ventilated, one great source of contamination of the milk was removed.

DR. REID (M.O.H. County of Staffordshire C.C.) stated that in his opinion so long as rural district councils were entrusted with the administration of the Dairies, Cowsheds, and Milkshops Order, there would be little chance of securing wholesome conditions in the milk trade, as farmers predominated in such councils. The powers in question should be transferred to central authorities, such as county councils.

ARTHUR S. BARHAM (London) said the paper, which had been read that evening, should appeal to all reasonable men engaged in the production of milk, and would, he trusted, assist in rousing the dairy farmers of the district to the importance of the question. It was a matter which could not be shelved, and, unless their country friends would of their own accord set their houses in order and enforce reasonable regulations, they would find that the authorities of large cities would take it into their own hands and obtain extensive powers, which might very probably be put into operation in an unsympathic and onerous manner. The crying need was that the farmers and their men might be educated to the necessity of cleanlinesss and care. No regulations would secure their co-operation so effectively as their own knowledge of the importance of the matter. They had the honour of the presence of the distinguished Dairy Steward of the Royal Agricultural Society of England, and he ventured to suggest to him that, at future shows the working dairy should not be entirely devoted to buttermaking, but that lectures and demonstrations, calculated to assist the farmers in providing a pure milk supply should be given, showing the ease and cheapness of such reasonable precautions as were necessary. In considering this matter, it was important that they avoided any measures which, otherwise desirable, would have the effect of materially advancing the cost of production. Milk was the only perfect food; its cheap and ready supply was absolutely essential to the health of thousands of infants in large towns, and any counsels of perfection which entailed much expense would, if carried out, defeat the very object in view, by restricting the sale of milk in the poorer districts.

J. REGINALD NAYLOR (Derby) said that his firm had recently been employed in remodelling a number of old farms and bringing the buildings into line with

modern sanitary requirements. The principal points aimed at were: the removal of the manure yard from the quadrangle round which the sheds were built, this space being enclosed and covered over, paved and drained, and used either for young stock or horses; the passage-way being all paved and drained, so that the cows had clean access to the sheds. In the sheds the floors were paved with impervious and non-slippery materials. The troughs were all of earthenware with sanitary angles and open gutters on the ground, leading all drainage to traps outside with sludge boxes, examination holes, and easy access to all parts for cleansing. He thought the marl bed used in many places was dirty and out-of-date. The ventilation must have careful attention, with properly placed inlets and earthenware extractors on ridge. These were always in order and needed no painting. He felt strongly that as much or even more care should be taken with the cows than was usual with horses to keep their surroundings and standings clean, and though at the present price given for milk there was little margin for improving buildings, still what he suggested was not expensive, and ought for the public safety to be considered. The cows could learn cleanly habits, and with good troughs and a clean supply of water outside, or with the water supply in earthenware channels at head of each beast where water was plentiful, he thought that instead of the milk being (as it often was) a positive danger, the udders and the beasts generally could be kept clean, and fear of harm from this source be considerably reduced.

Dr. Philip Boobbyer (Nottingham) said that in public health, as in other matters, it was necessary in the first instance to instruct public opinion, so as to secure a popular demand for those things that were known to be good for the community. Apart from all special efforts like the present, Derbyshire appeared to be doing a very useful work in this direction. The Americans were ahead of them, however, in many things, and he thought they had never demonstrated their superiority in the way of advertising a fact or series of facts for the instruction of public opinion better than in the recent case of the canned meat scandals. Sinclair's book had done much, but President Roosevelt had done more to rouse public opinion to its present shrieking pitch of protest against the abuses of the trade. The method was essentially American, and in its result, to use their own word, it was "immense." Of course they all know there had been a great deal of exaggeration and mis-statement connected with this business, and that many private axes were being ground upon the stone which the excited public were so industriously turning. The fact remained, however, that the scare was to some extent justified, and had been most skilfully and effectively engineered. But to return to their mutton, or milk. It was all very well to proceed temperately and tentatively so long as there was any element of doubt about the course they were taking, or the facts they were inculcating; but when the question involved was as simple as whether they ought or ought not to have cow-dung and all manner of filth with their milk, there could be no

e only question was, how ought they to
Dr. McCleary, at the Medical Officers of
dvocated the municipalization of all dairy
d that a gentleman, at Cork, was now doing
.t when Dr. McCleary read his paper, and
. a scheme as transcendental and Utopian, and
ing them into ridicule. He urged then, and urged
.e prosecution of a campaign similar to that above
to that which was being so strenuously pursued
own what phenomenal success had attended the efforts
or the Prevention of Tuberculosis to educate public
risks of infection from tuberculosus poison, and the
foul air for all of them. Let them then endeavour by
upon the public the urgent necessity of securing cleaner
and their children. In his own city (Nottingham) they were
.sions of their local regulations under the Dairies, Cowsheds,
nder. They had as yet no Municipal Milk Depôt, but there
blishments, conducted on orthodox sanitary lines, for the sale of
which served as object-lessons to the trade and the public. They
uring to confine the sale of milk to persons who were doing suffi-
ss to make it worth their while to spend a little money in keeping
. their plant, their premises, and their milk in a reasonably clean and
condition. Most other large cities were doing the same, but what was
quired most was similar work in rural districts, and he was inclined to
that such work had better be undertaken by the Local Government Board
Board of Agriculture. He had long despaired of rural district councils,
l was beginning to lose hope of county councils.

The following also took part in the Discussion:—Mr. E. Matthews and Mr. Blackshaw.

CONGRESS AT BRISTOL.

INAUGURAL ADDRESS

By the Right Hon. SIR EDWARD FRY, P.C., B.A., D.C.L., LL.D., F.R.S., F.B.A.

PRESIDENT OF THE CONGRESS.

Delivered July 9th, 1906.

IN looking forward to such a meeting as the present, perhaps the most obvious reflection that occurs to the mind is the indication which it affords of the progress of science, which I take to mean exact knowledge of subjects admitting of exact knowledge. The advances which have been made in the accurate knowledge of nature during the last half century have affected and are affecting not only our intellectual but our political and social life in a vast variety of ways, some of them beneficial, others of them to be deplored; for the increase of our control over the powers of nature which comes with the increase of knowledge is good or bad according to the motives with which those powers are used and the ends towards which they are directed.

It would be of great interest to trace the effects of the electric telegraph on the relations of principal and agent in trade, on the functions of diplomats in the councils of nations, on the spread of betting throughout the working populations of this country; to discuss the influence, not only upon international law and the rights of belligerents and neutrals, but upon the power and destiny of nations, of the new developments of the means of destruction by sea and by land; and, to come nearer to the objects of this Institute, to investigate the profound influence which bacteriology has had upon the growth of medical science and the formation of what may almost be called a new branch of knowledge.

And if it would be interesting thus to trace the parts of human life which have been influenced by the spread of science, it would be not less interesting to notice the regions of thought and the branches of human knowledge which remain unaffected by this advance. For, after all, it is not the greatest things which admit of the most precise knowledge and which are capable of being weighed or measured or seen through the microscope. Except to those whose mental vision is obscured by a too exclusive devotion to a certain class of investigations, the sense of beauty and sublimity, the emotions and affections of the human soul, the conception of duty, "the thoughts that wander through eternity," all these remain untouched and untouchable by any advance in science, and we seem to learn that the greatest and not the least of things are those which admit of no exact knowledge.

But from reflections so discursive as these I must recall myself to the point which I had more immediately in view, and must observe that one of the effects of an increase in scientific knowledge has been to increase the burthen of our duties, both as individuals and as citizens. In former years, the head of a household, in the event of the appearance of scarlet fever or even of smallpox, called in a doctor and perhaps a nurse, and kept the door of the bedroom shut. His drains he was content to regard as perfect, except when some sudden outburst of horrible odours called upon him to throw two or three buckets full of water down the orifices in his house. When he had done these things he had performed the whole duty of man. Now all is changed; the nurse and the patient are secluded in a separate room or rooms; the sheet wetted with a disinfectant fluid has to be nailed up at the point of communication with the rest of the house; the doctor has to wash his hands with disinfectants. When the rooms are vacated the paperhanger, the painter and the whitewasher have to be called in; the public officer of health has to be notified; and then the drains have to be looked to, and every new doctor of drains finds that the work of his predecessor was all wrong, that the system was faulty, but that now at last perfection is in sight. Such are the responsibilities and such are the sufferings of the modern head of a house; and when he has done all that I have mentioned, he is still left with an uneasy mind, in doubt whether he or the bacilli will win the day.

And as is the fate of the individual so is the fate of the municipality or other group of citizens. The State rightly requires of such bodies that they shall make due provision for what we now call public health; that they shall at any rate deliver their citizens from the dangers arising from the accumulation of putrefying matter and the contents of the drains;

and here the local body corporate finds itself in a dilemma: if it uses its nearest stream as an outfall and so defiles the water, it becomes obnoxious to the attacks of the riparian proprietors; or if it strive to put its refuse upon the land, it too often creates a nuisance to the adjoining occupants, and is the object of attack from the injured landlords and tenants.

From this conflict of duties and rights has arisen a vast volume of litigation and mandamuses to compel public bodies to perform their duties, and injunctions to prevent their interfering with private rights have been frequent as blackberries in autumn: and, as was to be expected, this mass of litigation has evoked the labours of a great army of experts, of engineers, architects, chemists, physicists, and other sanitary experts, and these have contended one against the other, and supported their opposing views with much scientific lore. To the onlooker at these contests there naturally arises the thought that a science which can admit of such a conflict of opinions must be in a more or less chaotic condition, and that much yet remains to be done before it can be considered to have reached the condition of an exact science, or of an unfailing guide to those who wander in ignorance and darkness.

Thus the bodies corporates of the country, and the individual householders, feel the burthen of these duties and responsibilities which the increase of knowledge has laid upon them; and from such dilemmas, such pressing difficulties, such conflicting opinions and advice we turn to you, ladies and gentlemen, to deliver us, by the deliberations of your several sections, and by the accumulated experience and wisdom which you possess. We look to you to restore to us the peace we enjoyed in the days of our ignorance, and to make the new life not only more healthful than the old, but as full of repose and peace. I know that the questions involved in sanitary science are many of them of much intricacy and difficulty, as well as of much interest, but we are all confident that as you pursue your labours from day to day and year to year you will more and more approach to an exact knowledge of the matters which arise, and will thus afford a more and more certain guidance to a public who earnestly desire some uniformity of advice from those whom they trust in such matters.

It has been often observed that arts and sciences, no less than cities and people, have their periods of advance and of retrocession, of rise and of decline; and to this observation sanitary science, I conceive, offers no exception. The ordinances of Manu, one of the most venerable of legal institutes, mention offences in diet as one of the things through which "the genius of death becomes eager to destroy" men, (translation by Sir W. Jones, p. 123): and the Levitical laws of the Jews

contain, as is familiarly known, many enactments of a sanitary character, especially in relation to leprosy: and so remote seems to have been the origin of these provisions, alike in Hindustan and Judea, that they appear already to us in the form of divine commands. Amongst the Greeks I know of no earlier traces of a consideration for healthful practices than are to be found in some passages of Hesiod, where he enumerates for us some of the rules of rural life in Bœotia some 700 or 800 years before Christ. The warning not to enter the house when affected by certain kinds of pollution, the prohibition of the doing of certain acts with unwashed hands, and of the fouling of streams and fountains, are all supposed to have the sanction, more or less direct, of the gods, or all may probably have had their origin in a care for the general health.

But it is to the Romans, and not to the Greeks that we look for the first practical works of a sanitary kind; and their earliest structures are such as still to challenge our admiration and our wonder. According to the Roman historians, to whom in this matter we may, I believe, give full credence, Tarquinus Priscus began and Tarquinius Superbus completed the great works for the drainage of Rome—of which the Cloaca maxima was the most remarkable feature. These works excited the warm admiration of the encyclopædian Pliny, and their construction appeared to Livy and the other Roman historians as one of the most remarkable of the works of the regal period at Rome: and the remains of the Cloaca maxima still pouring its effluent into the Tiber justly excite the admiration of the modern antiquary. Probably no drainage operation ever had so mighty an influence on the history of the world, for the result of these works was not merely to carry away polluting matter but to convert the low swampy land lying in the midst of the hills of Rome into the solid ground on which the Forum Romanum was constructed, and thus to afford a common meeting place for the inhabitants of the several communities of the several hills of Rome, that was to form the very home and nursery of the fierce Roman people, from whence they went forth conquering and to conquer.

Even more remarkable than the case of the Romans in the drainage of their city were their labours for the supply of their city with pure and abundant water. From the time of the great Censor, Appius Claudius, the builder of the Appian road as well as the great Appian aqueduct (312 B.C.) to the time of the Emperor Alexander Severus (cir. A.D. 221) Rome went on adding aqueduct to aqueduct, some of which still supply the city with water, until no less than eleven streams yielded their daily supply to the people of the Imperial city.

Another way in which the Romans showed their appreciation of practical

sanitation was the use they made of warm and medicinal natural springs. Almost every such spring within the wide circuit of their Empire still bears traces of their munificent baths. Our neighbouring city of Bath, the Aquæ Solis of the Romans, is a good illustration of the care and splendour with which they adorned the hot springs, to the use of which they were so much addicted.

A few months ago I visited in North Africa the remains of the town of Thamugas (now Timgad), built by Trajan for the veterans of the third legion, and I was much struck by the evidence which they afford of the care of these matters exhibited in the construction of the town. These ruins now stand in solitary grandeur amidst the desolate Aurès mountains, almost on the northern boundary of the Sahara Desert, and rival if they do not excel Pompeii in the impression they make upon the mind of the beholder; and not the least surprising thing in this magnificent city is the system of drains which were constructed down all its principal thoroughfares—drains that recall if they do not equal the dimensions of the Cloaca maxima of Rome. The city, moreover, was abundantly furnished with magnificent baths and cisterns of water; and in the house, I might almost say the palace, of Faustus, a man of great distinction in this remote city, one still sees the bath-room, and on each side, as you approach it, two pillars or pedestals, one inscribed with the name of the god Æsculapius and the other with that of the goddess Hygieia—so consciously did the Romans in this remote spot recognize the duty of seeking after health.

It is needless to observe that the Romans were without any of those scientific appliances on which we so largely depend, and were without that exact knowledge of the enemies to health upon which we rely. Nevertheless we find, as I have shown, that they were great sanitary engineers and constructed works of water supply and drainage not only in their capital but throughout their Empire upon which we cannot even now look without something almost of envy. If Rome in her ignorance could do all this for herself and for her remote provinces, what ought this country to do for herself and all the branches of her Empire?

Upon all this splendid civilization of Rome came down the barbarous North. The internal forces of the Empire were unequal to resist the impacts of Goth, Vandal and Lombard, and the fabric of the Western Empire went to wreck and ruin, and with it disappeared all thought of sanitary science—to remain, so far as I know, dead during the dark ages and to revive only in the course of the last century, and then in a new form and with means of investigation and of the ascertainment of exact

knowledge of which the wisest Roman never dreamed. Under such favourable conditions it is your good fortune to pursue your studies for the alleviation of some of the ills that beset poor humanity.

The work of Great Britain in the matter of sanitation is to be learned in part from the works which she has executed, but perhaps more from the legislation which she has enacted. The successive volumes of the statutes at large are, as it were, an automatic record of the thoughts and aspirations of the British people from year to year, and they testify to the fact that the first serious efforts to make life more healthy in this country date from the earlier days of Her late Majesty's reign.

Before that time there was no general legislation on the subject. Now and then some particular nuisance or inconvenience attracted the attention of Parliament, and municipal bodies or defined localities not unfrequently obtained powers in relation to sanitary matters within their jurisdiction, but it was not until the year 1847 that any attempt was made at unity in such legislation. In that year several Acts were passed which contained what may be called model codes or collections of provisions with respect to such matters as markets and fairs, gas works, cemeteries, and town improvements. But these statutes, contrary to the usual character of Acts of Parliament, had no operation until it was from time to time enacted by statutes referring to them that they should apply to this or that locality. In the following year, 1848, the first general public health Act was passed, which constituted a central controlling authority, the general board of health, and provided for the creation, by orders in Council, of local boards of health.

In the early seventies so great was the interest that had been excited in questions of sanitation that the brilliant leader of the conservative party in a speech at Manchester, in 1871, propounded as the watchword for his followers the maxim "Sanitas sanitatum et omnia sanitas," parodying by the alteration of a single letter the Vulgate rendering of one of the saddest utterances of the sad Hebrew moralist, and thus producing a jingle of words which will perhaps hardly bear a very precise analysis, but may have conduced to the legislation of the following year. The Public Health Act of 1872 was the first to apply legislation to the whole country outside the metropolis, to divide all England and Wales into sanitary districts, some urban and some rural, and to provide a local body in each district for the due administration of the laws relating to health. In 1875 there was passed a further Act which gathered together in one body the whole of the legislation on this subject, and thus forms a very important epoch in the history of sanitary legislation. In the following

year your Institute was founded with the intention of promoting yet further legislation, and for the purpose of collecting and imparting information upon all matters connected with the subject of public health, and your first two Congresses were presided over by Sir Benjamin Richardson and Sir Edwin Chadwick, two of the most distinguished advocates in those early times of the study of public health.

In the interval between those days and the present much has no doubt been done, but much remains to do, not only by a body like yourselves devoted to questions of public health, but by those who are concerned with the general social condition of our people; for health and morals are closely connected the one with the other. I trust that the labours upon which you are about to enter may be very fruitful of good results, and from those labours I will no longer detain you, except to express to you my high appreciation of the honour which you have done me in asking me to preside over your meeting here to-day.

CONGRESS AT BRISTOL.

LECTURE TO THE CONGRESS.

By Prof. C. LLOYD MORGAN, LL.D., F.R.S.

THE RELATION OF HEREDITY TO PHYSICAL DETERIORATION.

ONE must be blind to the patent facts of social life, and smitten with incurable optimism, if one fails to see that thousands of our fellow-citizens are born and bred under conditions which preclude normal and healthy development. Anæmic, underfed, and overworked mothers bear to alcohol-tainted husbands children who draw breath in an environment which, partly through ignorance, partly through wilful neglect, is hopelessly insanitary, and these children are reared with little regard to hygienic principles. This lamentable state of matters we seek to remedy; and it is your function to devise practical means for the improvement of the conditions of human development. But the practical problems to which your energies are directed involve questions which lie within the province of the biologist to discuss. Heredity is a biological problem. It is true that the life-circumstances of human dwellers in great cities differ from those which form the environment of wild animals. Still, the cardinal principles of heredity, so far as our knowledge goes, are the same for man and other mammals. It has therefore seemed desirable to your committee that I should speak to you this evening on the relation which the influence of the conditions of nurture bear to the hereditary nature of the individual and the race.

Let us first be clear as to what we mean by the individual, and what by the race. In the first instance, I suppose we understand by the individual some particular person—John Jones, William Smith, or Mary Robinson; and I suppose we understand by the race or the community

the sum or aggregate of the constituent individuals—say, in England or the British Isles. Now suppose that we make some general and comprehensive statement concerning this aggregate: suppose we assert that the race is deteriorating, or that Englishmen are improving. We do not mean that every individual person in the community is at a lower or a higher level of physical or mental excellence than his parents. As a matter of fact some are at a higher level, some at a lower, some at the same. We mean, do we not, that the net result of all the changes of level is either in the upward or in the downward direction. But how can we ascertain this? The only way to ascertain it with any approach to exactness is by the application of the method of statistics. No doubt we commonly make statements with regard to the deterioration or the improvement of the race on the basis of vague and general impressions, the result of more or less experience gained by dealing with some special class of facts. We have not collected accurate statistics, and we should probably not know how to deal with them if we had. None the less just in so far as we do make a general statement founded on the data afforded by observation, we adopt the procedure which the methods of statistics render more precise and accurate.

Let us consider, then, what we mean by saying that the race is deteriorating. We realise that only some of the constituent individuals are at a lower level than their predecessors, some being at a higher level, others being at the same level. To make our thought clearer we may divide the community into three cohorts, in one of which there is improvement, in the second there is no change, in the third there is deterioration. Then if we know the number of individuals in each cohort, the average amount of improvement in the one, and that of deterioration in the other, we can make a statistical assertion with regard to the direction and amount of change in the whole community, comparing the level of one generation with that of some preceding generation. Whether we base our assertion on *definite* statistics or not, when we say that the race is deteriorating, we mean that the third cohort outweighs the first.

Within each cohort, however, there will be a great number of persons, and in the first and third they will stand at different levels of improvement and deterioration, some showing much, others comparatively little. Our thought grows confused when we try to deal with these vast numbers at different levels. How can we simplify it? Let us consider first our middle cohort in which there is no change of level. In it, any person we might pick out at random would be representative of the whole cohort. We thus get the conception of the representative individual; we fix our

attention on him and let the others go. In the cohort of deterioration the persons are at different levels. But from among them we may pick out one who showed just the average amount of deterioration, and we might picture him as the representative individual. Similarly, in the cohort of improvement we might select one person who exhibited the average amount of improvement, and picture him as the representative individual. Then we should have our three cohorts represented by three individuals; and by comparing them we could say that the representative of deterioration showed a greater amount of downward change than that of improvement showed in an upward direction. But though the representative of deterioration would show the average amount of change of level he might not, and probably would not, represent the mean change of level when the number of individuals at different levels was taken into consideration. Suppose for example the cohort contained 50 persons, and that some showed 10 per cent. of deterioration, some 20 per cent., some 30 per cent. The average representative individual would be one of those who showed 20 per cent. of deterioration. But if the numbers were respectively 30, 15, and 5, then the mean amount of deterioration for all the persons would be only 15 per cent. No one person would show this amount. But we can conceive such a person. This conception would be what we may term the statistical individual. He would be representative of the whole cohort, taking both the amounts of deterioration and the number of persons into consideration.

We are all familiar with such, or analogous methods of representation, reduced to pictorial terms. The relative strengths, for example, of the navies of England, Germany, and France may be represented by three ironclad vessels of proportionate sizes. Similarly we might represent either their combined strength or their average or mean strength. So, too, with the three statistical individuals representative of our three cohorts in the community. We can conceive, though we cannot so readily picture, the statistical individual who shall represent the mean level of physical development of the persons in all three cohorts and therefore in the whole community. And if we compare this statistical individual of to-day with that of some generations ago, we can say whether there is improvement or deterioration in the race as thus represented.

I have, perhaps, used the terms "average" and "mean" somewhat loosely. It is not my purpose to consider the details of statistical method. My object is merely to indicate in outline the nature of our conception of the statistical individual who is representative of the whole community or of some selected portion of that community.

Now we have to try and make quite clear to our thought the ways in which a change of level in the statistical individual may be brought about. Let us go back to our three cohorts, and let us assume that the total number of the population is increasing in each succeeding generation. If there is a strictly proportional increase in the numbers of each cohort there is, other factors remaining constant, no change in the statistical individual. But if more children are born within or are classified under cohort 1, than are born within or are classified under cohort 3, the mean level will be raised. The physical characters of the race will be improved. If on the other hand there is a larger increase of persons classified under cohort 3 than under cohort 1, the mean level will be lowered. The physical characters of the race will from this cause alone, other factors remaining constant, deteriorate. This is believed by many competent people to be a really existent downward tendency. I prefer, however, to leave the question of fact an open one. But if those below the level of mediocrity marry earlier and have more children than those above the level, then we have here a factor in deterioration. And here we have a cardinal point in that doctrine of Eugenics which Dr. Francis Galton has preached, and which he hopes may be incorporated in the national conscience. All legitimate and decent means should be adopted, largely through the pressure of social opinion, which may lead to an increase in the births in that section of the community which contains persons above the level of mediocrity, and a relative decrease in the births within the cohort of deterioration.

A number of very interesting points arise in this connection, and further research will probably bring into increasing prominence the value of the statistical method. There is some evidence in the animal world which at any rate suggests that there is a definite correlation of fertility with the typical characters of a species. That is to say, in stable races, typical persons, those nearest in character to the statistical individual, are likely to be more fertile than those which depart in any marked degree from the normal. In the human race, Professor Karl Pearson, whose valuable researches demand our admiration and our gratitude, finds by an examination of some 6,000 cases that there is a correlation of fertility with height of stature in mothers of daughters. There is a balance of probability in favour of tall women having more children than short women; and, since stature is hereditary, he calculates that the stature of the statistical woman would, on the basis of the value he assigns to this correlation, be raised 3¼ inches in forty generations.

I cannot go further into details. It must suffice if I have helped you to

see that, other things equal, the mere number and distribution of births within our three cohorts are influential in either furthering or hindering racial deterioration.

We may now pass on to another question. What is the relation of the statistical individual, as representing the mean level of physical development in adult men and women under the actual conditions of their nurture, to what this individual might have been under the best possible conditions of nurture? Or again, What is the relation of the actualities of racial development to the hereditary possibilities? I fear these questions may sound like technical conundrums. Allow me to lead up to their restatement through some well-known facts.

Is it not an only too familiar fact that there are thousands of pale, peaky boys and girls in the more congested parts of our great cities, who will grow up to manhood and womanhood under conditions which must prevent their attaining the strength and vigour which they would have possessed under more favourable circumstances? Are there not also thousands of office-bound men and women who break down under the strain or the monotony of their work, through no hereditary defect—who would not break down were their lot less severe and their life less cramped? Of such facts, you will say, we do not need to be reminded. They are the inevitable accompaniments of our social system. They are the penalties which the community has to pay in return for the privileges of a highly evolved civilization. So be it. But mark the implication. The child comes into the world the heir to a constitution, in virtue of which he may reach a level of physical development the limits of which we could, with adequate knowledge, assign. It varies, of course, with different children. All do not fall heirs to the same amount of inborn vigour. But the variations could, if science were fully equal to the task, be treated statistically. Suppose that this were done. Then we should reach the conception of the statistical individual as he might be under ideal conditions, with which we could compare the statistical individual as he is under actual conditions.

In this connection we may revert for a moment to the question I asked at the outset: What is the race? When we speak of the improvement or the deterioration of the race, we may mean one of two things. We may mean the race as represented by the statistical individual in his actual state of development under existing conditions of nurture. Or we may mean the race as gauged by its hereditary potentialities. It would be convenient to use the word "race" for the former; and to reserve the term "stirp" or "stock" for the latter. Deterioration in the race does not necessarily imply degeneration of the stock.

It is probable that in wild animals, under normal and natural conditions, the level of attainment in the race does not fall far short of the hereditary possibilities of the stock. The wild animal in the stress of active and vigorous life, subject to a keen struggle for existence under which weaklings are eliminated, actually *is* pretty nearly all that he *can be.* The interval between the existent statistical wolf and the wolf that he might be under ideal conditions, is probably a narrow one. Severe as the conditions of life are, they present, under a keen struggle for existence, nearly the ideal conditions for the development of wolf-nature.

The case is different, however, with human folk in the social state as it now is, for example, in England. Here the question I put before you is a really important question, though we may not be in a position to give a very definite answer. What is the relation between the actually existent individual representative of the race, and the ideal individual who should realize to the full the whole of the hereditary possibilities of his stock?

We all know that on any theory of heredity every child that is born into the world is the product of the union of germinal contributions from two parents. The germ-cells are the medium of hereditary transmission. All that a man or woman becomes in the course of development is latent in the germ; it is then potential. But probably no human being realizes or actualizes the whole of the inherited potentiality. That is equivalent to saying that existing conditions of nurture fail to afford the co-operating influences necessary for the development of all that the hereditary nature could produce under happier circumstances. Few of us have the opportunity for making the best of these physical and mental possibilities.

Some of you will perhaps resent the use of these terms, "potentialities" and "possibilities." I do not like them myself; but what others can one use? The essential thing is to grasp exactly what they mean. The conception of the relation of the organism to its environment is now quite familiar. Given a normal embryo, and given also a favouring environment, we can state what the course of development will be; and we can do so because we have submitted the matter to observation and research. In any case, the statement is the outcome of actual experience. The grain, in the parable of the sower, yields some thirty-fold, some sixty, some a hundred. Given the best conditions we can count on the hundred-fold yield. Of such yield there is in the seed the latent potentiality: but this is dependent on structure and functional activity actually present in the seed. In virtue of its vitality it is a going concern, and we can foretell its future course if we know the influences to which it will be subjected. If then we say that the human infant has certain hereditary potentialities or

possibilities of development, we mean that it inherits such structure and functional activity as will, under favouring conditions, give certain assignable results. In the case of any given child we cannot accurately gauge its hereditary dower, nor say exactly how much of its inherited capital is realized in the course of life. We know more about the statistical infant than we do about the babe who will be christened John Brown or Maria Jones. But we do not know what percentage of statistical potentiality in the stock is realized in the statistical actuality in the race. Let us assume, however, that in the normal representative individual eight-tenths of the hereditary potentiality is, through physical training and education, rendered actual. Then the average development being 80 per cent. the most favoured may attain, under optimum conditions, to, say 90 or 95 per cent., while the unfortunates may fall short by varying amounts, say 10 or, in extreme cases, 25 per cent. These figures are merely illustrative; we know little at present concerning the actual percentage values. My aim is merely to render clear the unquestioned facts that there are wide variations around the mean of actual development, and that there is a considerable interval between the mean of hereditary potentiality in the human stock and that of realized physical and mental attainment in the human race. This is especially marked under the complex conditions of our social life, and gives rise to difficult social problems.

Revert now to the parable of the sower. Suppose the grain is sown on stony ground; and the scanty yield of seed is again sown on stony ground; this being continued for several generations. Then we should say that the wheat gave deteriorated crops. But how shall we define this deterioration? I suggest that we should define it as the short-coming from the normal level of development. On this view deterioration is the result of unsatisfactory conditions of nurture, not necessarily the result of any lack of hereditary potentiality.

Let us now see how we stand. The race may be represented for our thought by a statistical individual who reaches a normal level of development. That level is lower than it would be under optimum conditions, which would produce the ideal maximum of attainment. If the statistical individual of one generation is at a higher level than the normal of any given predecessor the race is improving in its physical and mental development; but if the statistical individual stands at a lower level of development the race is deteriorating. The efforts of such an Institute as this are directed towards the improvement of the race by bettering the conditions of life and the checking of deterioration in congested districts.

But is deterioration as I have ventured to define it the same as degene-

ration? This is really a very important theoretical question having an equally important bearing on practical problems. First let us note the distinction implied by the use of the two terms. What is that distinction? We have seen that the representative individual has certain hereditary possibilities. Assume that these remain constant through a series of generations. Deterioration may still occur; for deterioration is due to some failure in the due development of the hereditary potentiality. What then is degeneration? It is a lowering of the hereditary possibilities. It is not only a shortcoming in the level of physical and mental attainment: it is a depreciation of hereditary capital. It means not only that there is a failure in realizing all that is bequeathed through heredity, but that there is a diminution of the racial bequest. It means not only that the actual physical status is lower than it might be under bettered conditions, but that so high a status as heretofore is no longer possible. Hereditary degeneration is a far more serious matter than physical deterioration.

Revert again to the parable of the sower. Suppose the grain is sown on an inhospitable stony soil for a dozen generations. The crop deteriorates; it fails each year to reach the normal standard of development and yield. But there need not be any degeneration. The seed produced by the twelfth generation may produce, in a favourable soil and under the best conditions, a hundred-fold yield. I say it *need* not show signs of degeneration; whether it does or not is a question to be determined by observation. At present we are concerned with a distinction in terms. By deterioration we understand a lowered level of development; by degeneration a lowered level of the hereditary possibilities of such development, no matter how satisfactory the conditions may be, and the latter, I repeat, is a far more serious matter than the former.

It must not be supposed that, in attempting to draw a distinction in terms between hereditary degeneration of the stock and what the biologist would term an acquired deterioration of the race, one is forgetful of the fact that in sociological fact the two are closely related. It is, indeed, in view of their close relationship and its logical treatment that the distinction is drawn. I have already drawn attention to the fact that the relative rate of increase of the population in our three cohorts, in itself and apart from other factors, may lead either to improvement or deterioration. We may now note that just in so far as the hereditary possibilities are raised or lowered there is also improvement or degeneration in the stock. If those with less hereditary vigour are, from any cause, reproducing their kind with greater rapidity than those with greater hereditary vigour, then the race must be degenerating, unless there are other factors of improvement

which counterbalance this tendency. At present, however, I am chiefly concerned to render intelligible the logical distinction between racial deterioration and the degeneration of the human stock.

If, then, I may assume, that the logical distinction is sufficiently clear, we may pass on to the consideration of one aspect of the relationship of what is hereditary to what is acquired. Does physical and mental deterioration, as such, lead to degeneration? Or, to put the question in another form, Is deterioration in one generation handed on as a degeneration in the next? And conversely, does physical and mental improvement lead to greater hereditary endowment in succeeding generations? Omitting certain qualifications, to be presently noted, I believe that the balance of expert biological opinion is in favour of a negative answer to these questions.

I must crave your indulgence if, in that which now follows, I fail to steer an open course between the Scylla of undue technicality and the Charybdis of the already familiar. All the higher organisms, man included, are developed from germ cells which enter into fertile union. These cells are the bearers of hereditary characters. Picture such a reconstituted cell as the starting point of organic development. It divides, its products subdivide, and the process of division continues until the multitude of cells of which the organism is composed results. The great majority of cells, which assume different forms and perform different functions in the animal economy, build up the bodily tissues, muscle, skeletal frame-work, brain and nervous system, and so forth. A minority produce germ-cells which hand on the torch of life. Thus germ-cells produce germ-cells, the bearers of hereditary qualities. They also produce body-cells which, sooner or later, die. But the body-cells never produce germ-cells. That, in brief, is the doctrine of germinal continuity; that the primary basis of hereditary transmission. But may there not be secondary or subsidiary means by which the well-trained muscles or the highly developed brain may communicate to the germ-cells those excellencies which they have acquired in the course of personal life? No doubt there may be. But of this there is no biological evidence. Indeed, it is difficult to conceive how it can be effected. Moreover, many of those who have discussed the facts of hereditary transmission are of opinion that they are not such as to demand any such explanation. The doctrine of germinal transmission covers all the known and well-verified observations without remainder. On this head, however, there is not universal agreement. But I think we may accept this doctrine as sufficient on the evidence at present forthcoming. That means that modifications of structure or function

acquired in the course of personal life are not inherited whether they be in the direction of improvement or of deterioration.

We must, however, be clear as to the kind of modifications of structure and function which are, on this view, without influence on hereditary transmission. Perhaps it may best be put in this way: every organic tissue requires its due amount of exercise in the performance of its functional activities. It is also trained in the execution of its proper task. If well exercised and trained it improves within the limits of its hereditary possibilities, if ill exercised it deteriorates; it becomes sluggish in action and slack in the performance of function. Muscles get flabby, brain-centres become inert. But neither the improvement due to exercise and training, nor the deterioration of structure due to disuse and lack of training, afford the kind of modification that is transmitted to offspring. That is what is meant by saying that the acquired characters which are the effects of use and disuse are not inherited. If this be so, then such deterioration as is due to disuse, want of due exercise of certain bodily tissues, lack of training in muscle or brain, even if continued through many generations, does not rob succeeding generations, reared under better conditions, of their goodly heritage. On the other hand, the effects of education in manipulative skill or in intellectual development, even if continued through many generations, do not enhance the value of that heritage. It is indeed difficult to conceive how either the adequate exercise and effective training of the muscles or the nerve-centres can so affect the germ-cells as to render the effects of such training hereditary; and equally difficult to conceive how lack of exercise and training can be transmitted to offspring. Nor is there convincing evidence that the effects of use and disuse are, as a matter of observation, inherited.

On the other hand, there is a class of facts, on which further research is needed, which seems to justify a different conclusion. There is little doubt that certain drugs taken into the system, certain products of the microbes of disease, and certain by-products of the tissues act as poisons, and not only hinder the development of the body but impair the functional efficiency of its organs. In other words, they lead to deterioration. There seems, too, to be some evidence that this deterioration may be progressive; that is to say, it becomes more marked in a series of generations subjected to the deleterious influences. If this be so, it would seem that the hereditary possibilities are progressively lowered; but this is what we have spoken of as degeneration. Hence it appears that deterioration in one generation may be causally connected with degeneration in the next. It is commonly believed by medical men that the alcohol habit gives rise not

only to deterioration in the parents who are addicted to drink, but also to a liability to certain nervous and other disorders in their children, who are thus so far degenerate. But the statistics are difficult of analysis, and the relation of cause to effect peculiarly difficult to trace. Assuming, however, that the commonly accepted opinion is correct, it is probable that since the whole system of the alcoholic parents is permeated by the drug, or by abnormal products of tissue-change or metabolism due to its excessive use, the germinal substance is likewise affected. All the tissues deteriorate; and among them that of the organs which produce the reproductive cells. If this be so, the degeneration in question is due to the deterioration of the germinal substance.

Experimental work, under controlled conditions, on the lower animals will probably throw more light on the nature and results of the deterioration of the germ-cells. Already there is some evidence; but more is required. Dr. Vernon and others have collected data which enable us in some degree to estimate the effects of excretory products on growth and development. His observations on Echinoids seem to show that they exercise a deleterious effect. And the following observations by Mr. Whitfield which he quotes indicate progressive influence. Mr. Whitfield kept a water snail (*Limnœa megasoma*) in a small aquarium, "and after some months it deposited eggs. These hatched out, grew in size, and in due course themselves deposited eggs. This process continued for four generations in all, the shells of each generation being smaller than those of the one before. Those of the last generation had altered so much that a conchologist of experience was of the opinion that they could bear no possible specific relation to those of the first. Thus in addition to the diminuation in size, the spire had become very slender. In a second experiment of a similar kind, the shells of the third generation were only 4-7ths as long as those of the parent stock, and, still more remarkable, the male organs had disappeared, whilst the liver had become considerably reduced in size. These extraordinary effects were probably due to the cumulative action of the increasing quantities of metabolic products in the water, in which the mollusks were living."

I quote this case not because the evidence is to my mind wholly conclusive, but because it shows the kind of evidence which experimental work may furnish. If in three generations the male organs had entirely disappeared it is obvious that the germinal substance must have been profoundly influenced.

Now there is an increasing body of opinion among those biologists who have paid attention to such problems, that acquired characters are not

inherited. If that be so, the deterioration of the individual due to unsatisfactory conditions of development, is not transmitted to his offspring. But if the kind of evidence, to which I have just drawn your attention, should by further research be increased in volume and cogency, as appears to me not improbable, we shall have to distinguish between the deterioration of the germinal substance and that of the other bodily tissues. I do not, of course, claim any novelty in this suggestion, I merely desire to render the distinction clear and comprehensible for our present purpose. Our generalised statement will then run as follows: Deterioration of the muscular, skeletal, nervous and other bodily tissue, in so far as it is acquired during personal life, is not inherited; but deterioration of the germinal substance, through the influence of poisons or metabolic products, may lead to degeneration of the stock. This is probably a quite unimportant factor in animal life under normal conditions, because natural selection involves the elimination of such degenerates; but in human life it may be of sufficient importance to be reckoned with in any discussion of heredity in its bearing on social problems.

We pass now to what has been unquestionably a dominant factor, if not *the* dominant factor, in the evolution of the lower animals—natural selection. It is unnecessary to do more than remind you of the more essential points. The first Darwinian position is that there is overproduction of offspring. The birth rate is in excess of that which is requisite to keep up the numbers of the species on the assumption that all survive to mate and breed. Hence there must be some percentage who fail thus to survive, and who are in some way eliminated. The second position is that variations occur—that those who are born are not all alike. This is a matter of common observation, and the variations may be treated statistically by the modern methods of biometrics. The third position is that there is a "struggle for existence." The phrase is in some respects an unfortunate one. The essential feature is that the conditions of life are such as to cause a certain amount of elimination. The fourth position involves a very probable conjecture. Granting that there is an elimination of certain individuals under the stress of life conditions, and granting that there are variations—some in favourable, others in unfavourable directions—it is probable that those which are eliminated are those whose variations are in an unfavourable direction, and those which survive to mate and breed are those which are better adapted to their environment. It is difficult to establish this position on the basis of statistics, because it is but seldom that there is an opportunity of examining the eliminates and comparing them with the survivors. Still, there is now some statistical

evidence, and modern methods of research will probably increase its volume and its range. Lastly, the fifth position of Darwinism is the inheritance of adaptive traits, in virtue of which the survivors escaped elimination.

Let us divide the newly-born offspring of a species or race into three cohorts. The first contains those whose variations are in a favourable direction, the second those whose variations are neither favourable nor unfavourable, the third those whose variations are unfavourable. Under natural selection elimination preponderates in the third cohort. This contains the degenerates. But where natural selection is rigid and severe, degeneration, though it occurs, is not perpetuated, because the degenerates of the third cohort are weeded out.

Of late years much research has been directed to the further elucidation of nature, range, and mode of origin of variations and the laws of their inheritance. On the one hand, experiments are being conducted on lines suggested by the Abbé Gorgor Mendel; they are of too technical a nature to be here described. On the other hand these and other data are being examined statistically on improved methods, devised by Dr. Francis Galton, and developed by Prof. Karl Pearson. Galton's law is now well known. The statistical individual derives half of his hereditary characteristics from his parents; one quarter from his grand-parents; one eighth from his great-grand-parents; and so on. Applying this law to Basset hounds of two types, known as "lemon and white" and "tricolour." Dr. Galton found that in a certain generation there were 181 tricolours; on the basis of this law there should have been 180. In this case, the colours of parents, grand-parents, and great-grand-parents were known. In a second case, where parents and grand-parents only were known, the observed number was 387 tricolours, compared with 391, the number calculated on the basis of the law of heredity. This is not the place to enter into further details. The essential point is that variations do not occur haphazard, but in accordance with rules of general validity; and that on the basis of these rules there is a calculable probability of the inheritance of such variations. In other words the third and fifth positions of Darwinism—that variations occur and that they are inherited—have been rendered more certain and more definite; and it has been conclusively shown that they apply to man as well as to the lower animals.

In accordance with Professor Karl Pearson's further developments it is now possible to assign values to the coefficient of hereditary correlation between brothers, and between a person and his parents or more remote ancestors. A new value, slightly different from Dr. Galton's, is assignable to the coefficient of regression towards the ancestral type. It must

be remembered, however, that these are statistical results based on a refinement of actuarial methods. If it be said that such conclusions do not apply in the case of Shakespeare, for example, of whose brothers nothing striking is recorded, there is a sense in which this is true and a sense in which it is false. It is true in so far as we are unable, at present, to foretell in what degree any given infant will depart from the statistical mean. It is false if it implies that such a person must be excluded from the data under statistical treatment. The mean result can only be obtained if all degrees of departure from the mean are taken into consideration. If it be said that such conclusions, though they may apply to physical and bodily characters, are not applicable to mental characteristics, it must be replied that difficult as the investigation must of necessity be, such data as are obtainable (and they have been treated with great skill and care by Professor Pearson and his fellow-workers) seem to justify the conclusion that approximately the same coefficient of fraternal correlation applies to mental characteristics as well as to physical characters, such as stature and skull measurements. In any case it is clear that where the physical deterioration or degeneration of the race or stock is the subject of enquiry, the statistics which give the mean results for large representative numbers of the population afford the only reliable data for scientific generalisations. And it is now beginning to be recognised that one of the lines along which further developments in the theory of natural selection are to be expected, is that of the statistical treatment of accurate biometric data.

Before briefly considering how far natural selection is a factor in human evolution under the conditions of civilisation, it will be desirable to note in what respect the method of the cattle breeder or the pigeon fancier differs from that which obtains under nature. The essential difference is this: Under natural selection there is a progressive elimination from below upwards. The least adapted and most degenerate are the first to go. The incidence of elimination is in our third cohort. But in artificial selection the breeder chooses out what seem to him the best of his stock from which to breed. The most highly adapted are intentionally and deliberately picked out. The incidence of selection falls on the chosen few in the first cohort. Now if moral considerations permitted, we could unquestionably improve the human race by applying the methods of the cattle-breeder. But, of course, they do not permit. Still, in accordance with the principles of Dr. Galton's Eugenics something may be done, by the pressure of public opinion, and by a fuller personal realization of the principles of heredity, to encourage the perpetuation of the best stock, and

to discourage the marriage of degenerates. It is a delicate and difficult question. Perhaps, at present the best that can be done is to open people's eyes to the fact that in the matter of heredity we do not live in a haphazard world in which the physically degenerate have just as good a chance of bearing healthy and vigorous children as their more happily constituted neighbours.

Passing now to the question as to how far natural selection obtains, under the social conditions of human life, we must be on our guard against a not uncommon, but quite fallacious mode of argument. We often see it stated that since natural selection is dependent on the struggle for existence, and since under present social conditions there is a terribly severe struggle for existence, therefore, it follows that natural selection is constantly in progress among mankind. It does not necessarily follow. It only follows in so far as, under this struggle, men and women are prevented from marrying and begetting children. As things are, probably the struggle is most severely felt by those who marry, and have families which they have difficulty in supporting. Of course, there is some exclusion from parenthood through the struggle for existence. But there is a good deal of flying to matrimony, as a comfort and solace in the midst of stress, or when it temporarily relaxes, accompanied by a pious hope that the children which arrive, with becoming regularity, will not be left destitute of support.

That natural selection, in the strict sense of the term, is still operative in human evolution, is probably best seen in the statistics of disease. They are not easy to deal with; and further research is needed. But there is a presumption in favour of the contention brought forward by Dr. Archdall Reid. In a civilised race in which a disease has been prevalent for many generations, the inhabitants are less susceptible to the attacks of this disease than peoples among whom it has not been prevalent. This may be due to acquired immunity transmitted to offspring; or it may be due to the fact that susceptible persons have been steadily weeded out, leaving those who are not susceptible, or less susceptible, to carry on the race. Dr. Reid unhesitatingly accepts the latter alternative. If he is right there is natural selection by the elimination of the susceptibles. He applies the same principle to the alcohol habit. He contends that temperate races are such because the intemperates—those whose inborn proclivities lead them to excessive indulgence—have drunk themselves to death, leaving those with moderate appetite for alcohol to be the parents of a temperate race. It may be so, though I am not at present fully satisfied that it is so. Still it is an interesting suggestion, and puts a new

aspect on the temperance question. In any case, it illustrates how natural selection may still be operative among human folk.

Assuming that Dr. Archdall Reid's contention both in the matter of disease and in that of alcoholism is sound, then, apart from what most of us would regard as moral considerations, the doctor and the temperance advocate are in some degree enemies to the cause of progress. The more thoroughly disease and drink do their fell work, the less susceptible will the human stock become to their ravages. But if the doctor and the temperance advocate were incontinently abolished it is not unlikely that the race would lose more than it gained. Although they may minister in some degree to degeneration, they do much to check deterioration. Granted that they may to some extent lower the level of human potentiality, they do much to raise the level of human actuality by bettering the conditions under which men live.

Let us now, in conclusion, review our whole position. We have drawn the distinction between deterioration due to adverse conditions of development, and degeneration as a lowering of the inborn possibilities of such development. Degeneration affects the stock; both degeneration and deterioration affect the race. Except in so far as deterioration, acquired in the course of personal life, affects the germinal substance through the influence of poisons or metabolic products, it has probably no influence on the inborn potentialities of the stock; it does not lead to degeneration. Apart from such germinal deterioration, heredity is wholly a matter of congenital variations and entirely independent of the conditions of nurture. Though much further research is required, certain broad statistical laws of heredity are already firmly established; and there is no doubt that both favourable and unfavourable variations are inherited. If civilised man were influenced only by strictly biological considerations there is no question that the human stock could be improved both by selective breeding according to the methods of artificial selection, and by deliberately allowing natural selection to have free play, with the resulting elimination of the unfit. This course is, however, repugnant to the moral conscience. Civilised men are swayed by other motives than those which appeal to the cattle-breeder. Apart from the development of a Eugenic conscience, apart from quickening a realising sense of the responsibilities of parenthood in relation to the known laws of heredity (and not merely some popular travesty of these laws), it would seem that, under existing ideals, comparatively little can be done to lessen such degeneration as may be in progress.

That, however, does not mean that little can be done for national well-

being. On the contrary, much may be done, much is being done, to diminish deterioration. If the hereditary possibilities are to a very large extent beyond our control, all the more imperative is the call on us to so to better the conditions of life as to enable men and women to make the very most of the existing hereditary possibilities. That we can assuredly do by legitimate social means. All sanitation, all physical and hygienic training, all education are means to this end; they further personal development and check personal deterioration, whatever else they may not be doing. We have to deal with the human organism and his environment. What the organism becomes in the course of development is a joint product of nature and nurture, of hereditary possibilities and the conditions of life. Granting that we can do little to raise the hereditary possibilities, we can do much to improve the conditioning environment.

CONGRESS AT BRISTOL.

POPULAR LECTURE.

By Councillor W. FLEMING ANDERSON, J.P.,

Chairman of the Health Committee of Glasgow.

ABSTRACT.

THE WASTAGE OF HUMAN LIFE.

IT has been my privilege for the last fourteen years to be a member of the Public Health Committee, and for the last four years I have been burdened with the responsibility, as well as the honour, of being Chairman of that Committee. It has been my duty in the course of my experience to see and to know the terrible facts of the lower forms of life in a great city, and to become convinced that there is no work and no duty to which we are called as citizens so grand, so intensely real, and so urgently clamorous as the putting an end to the iniquitous and unholy waste of human life which prevails in our great centres of industry, and in a lesser proportion in the smaller districts of our great Empire. The aim of all sanitarians is not, in the main, to cure disease, but to prevent disease, and the object of this Congress is not only to gather information, but to spread it. And let me say here how much we laymen appreciate the efforts of the faculty of medicine. How different these are from those of the ordinary business man who seeks to bring as much business as he properly can to his particular department; what a contrast it is to find the men in our medical profession, who, while active in seeking to cure the diseases of humanity, band themselves together in order that they may not only cure, but may devise the very best means of preventing those diseases which it was their mission to cure?

Now let us look at the enormous strides public health has made during the last half century. In 1855 we got compulsory registration. I am now giving samples of what has been done in Glasgow, because the

statistics and facts are known to me, and it is practically a reflex of what is going on all over the country, and I do not make these quotations in any boastful or egotistical spirit, but only to illustrate what is going on all over the country. 1855 was, I say, the year in which we got compulsory registration, and it was in 1862 that we had our first period of awakening in Glasgow under our first medical officer, who still lives to enjoy the well earned repose and the loving gratitude of the army of men that he has trained—he is now Professor Sir William Gairdner. What did he find? No staff; no hospitals; no nurses; typhus cases by the thousand; no disinfection; no notification of infectious disease; no limit to the over-crowding in the houses, and worse still over-crowding by rapacious landlords placing houses on ground which was meant to be open spaces for all time.

In 1875 the death-rate of Glasgow was 30·8. Let me explain that when our death-rate is reduced by one it means a saving in Glasgow of 800 lives per annum. In 1875 our death-rate was 30·8, and in 1879 it touched its then lowest point—it was 24·6. Last year our death-rate was 17. Scarlet fever, typhoid, diphtheria, and consumption—all these things have gone down by leaps. Smallpox has very nearly disappeared, typhus is practically abolished, there has been an improvement all along the line, and yet why is it that with all that improvement in every phase of life—from five years and upwards there has been this great improvement—and yet to-day the infantile death-rate of this country is as high practically as ever it was, and in some parts of this free Britain worse than it was over 40 years ago? Why is this? Some people when I have spoken to them about it say, "It is a good job; survival of the fittest, there is no use rearing delicate children." I decline to accept the theory that this must go on, and that this state of things is not curable; I decline to accept that it is the Lord's will that these little ones should perish. Whatever may be the material circumstances attending the procreation and birth of the child, however sordid and unlovely this may be, there is in the entrance of every child into this world a new creation which is immortal and indestructible, a raindrop from the Divine fountain—the history of another body, soul, and spirit has begun to be written. However lowly, however wretchedly born, however squalid the surroundings, each child comes fresh, clean, and new into the world of life, full of fresh potentialities, with unknown and unlimited possibilities for good and evil, of hopes and miseries, of creation or destruction. Everything good and fair is possible to each child as it opens its eyes on this world if—and what an if—if it gets a fair chance, and every child has a right to demand by all the laws of God and nature a fair chance.

Now what do I mean by a fair chance? A fair chance has clearly these conditions—first the parental care, love and affection as will draw out its natural powers in the moral and mental state; a fair chance is good food, good sunlight, proper clothing, exercise, cleanliness; children's pleasures; above all it must be prevented from dying, as that is the end of all things.

Well, this is my subject—the wastage of human life; the cruel, terrible, wicked, criminal wastage which prevails in this great Empire of ours in this year of grace, 1906. In itself and by itself it is a wanton waste of God's greatest gift to the world of man. Life—what is it? It is not rank, or wealth, or ambition, or education, or work, or food, or dress—yet this thing which mature man places before all is allowed to be wasted. Why? Is it because its victims are unable to articulate their ill usage, except by a cry which so often falls on deaf ears, and may, if heard, be misunderstood. It is not only these deaths, but it is their attendant circumstances. The picture is full of terrible misery such as to make one's heart sick, while the loss to our country by these units of our progress is to the nation a loss which cannot be measured. We talk about the carnage of war and are shocked by the loss of valuable lives in a great battle. Why, every day in this country we are engaged in a battle more bloody than those of the South African war in which there is a great and ceaseless loss of that most valuable of all national assets—human life.

Talk of Empire. In my judgment Empire does not consist of the countless millions of acres, but in the health and happy living of all classes of an industrious and contented people. We battle and fight to protect and acquire property, and slay and are slain in the struggle, but in this battle the innocent slain have no weapons and can offer no resistance, but they feebly perish, impotent and helpless, or if they survive they are tainted in mind and body, a burden to themselves and their fellow creatures, and to the State a national loss instead of a national gain.

Recently in London we had a Conference upon infantile mortality, and we were fortunate in having the patronage of our King and Queen, and we were also fortunate in having as the President of that gathering the President of the Local Government Board, and he made this statement, which is true—that there are in the United Kingdom over 100,000 infants under 12 months old who are ruthlessly put to death, not willingly but through ignorance and vice. Let me give you this figure: In Scotland our infantile death-rate is 25 per cent. lower than the death-rate of England and Wales; that is to say, if in Scotland the babies died at the same rate as they are dying to-day in England and Wales we would

have an additional death-rate of babies in Scotland of 3,249, or say in the ten years a loss of 32,490. Or to put the thing in another way: If the death-rate amongst babies in England had been as low as the death-rate amongst infants in Scotland there would have been a saving every year of babies in England and Wales of 23,249, or during the ten years of 232,490. In England the death-rate from 1893 to 1902—ten years—and we take ten years because it is supposed to be reliable for statistics, was 152; in Scotland it was 127, and in Ireland it was 104. Why? Because Ireland is a poor country, and there most of the mothers give their babies their birthright and suckle their own babes. Let me here remark as another instance, that during the siege of Paris the death-rate among infants went down enormously because the mothers were confined to the home and had no occupation and nothing else to do but to look after those in their own homes. Now is it not a very sad commentary upon our boasted education and enlightenment to find that while in England and Wales the death-rate is 152, it is so much less in our Colonies. In New South Wales it is 111, Victoria 109, South Australia 106, Queensland 103, Sweden, whose representatives come here to learn from us, comes out at 99, Norway 94, and Tasmania 93.

I do not believe that illegitimate children come into the world less healthy than legitimate, but it is a fact that they die in infancy twice as quickly as legitimate children. The average for six years in Glasgow of the deaths of legitimate children from 1898 to 1903 was 139 per 1000, while the death-rate among illegitimate children was 241, and at the Conference to which I have referred it was stated that in one of our English cities it is a fact that roughly three out of every five illegitimates die before they reach their next birthday. Why this great difference in the death-rate between legitimates and illegitimates, when we know that the death-rate of illegitimate children nursed by their own mothers does not vary appreciably from the general rate of mortality for all England? What do these statistics point to? There may be, of course, occasionally pre-natal causes induced by the fear of the discovery of the mother's condition, but I think there is no doubt that a large measure of this mortality could be prevented. The existence of the child is in itself a strong incentive to do away with it, so long as we wholly blame the mother and she is held up to the contempt of society, in addition to bearing her own shame, which is often accompanied by poverty. I think it also a disgrace that the putative father, when he does contribute, should contribute such a miserable pittance so that the child has to be handed over to some outsider to nurse, and I have never yet been able to understand why it is

that the woman is looked upon with reproach, often by her own sisters, when the father for some reason is not subjected to the same ostracism.

Then again, what swells our death-rate is the positive cruelty which is perpetrated on numbers of these children. The Society for the Prevention of Cruelty to Children had in six years 25,000 odd complaints before them; of these, 21,000 were proved, and the great bulk of them related to babies. In addition to cruelties there are a great number of them who die by actual violence, and it is astonishing to find how many of these are suffocated every year. I do not know that I need trouble you with the 1,000 cases of children who were overlaid—that is the polite word for it—who were suffocated. The bulk were suffocated between Saturday night and Monday morning; 283 on Sunday night; 141 on Monday; 137 on Tuesday; 116 on Wednesday; 115 on Thursday; 107 on Friday; and 118 on Saturday. It shows, of course, that liquor again is at the bottom of this problem, as it is at the bottom of most of our social problems.

Now I will endeavour to deal with some other matters, and also give you some idea of one of the methods we are trying to establish in Glasgow in order to bring about a different state of things. Up to this point I have been dealing with the deaths of infants who have lived. I have now to refer to another very serious thing that was brought prominently before the recent conference, dealing with children who should have been living, but were born what is called "still." Statistics show that in 1906 our sanitary authority buried 122 still-born babies at the expense of the city, and of those 41 were illegitimate; in 1905, 142; in 1904, 121; in 1903, 142; and in 1902, 114; or during these five years we buried 641 so-called still births, 218, or 34 per cent. of which were illegitimate. My contention here is, and I make it because of the statements which were made by some of our most respected medical officers of health, that a great many of these children who were put out of the way as still-births were born living, and were deliberately allowed to die at their birth; and the reason that no punishment followed this, in my eyes, crime, was because at the present moment still-births are not registered, and therefore we have no record really of what happens.

We will pass on. When I knew that I was to come and give this address to this Congress, I asked our sanitary inspector if he would be good enough to get for me some snap photographs of various babies throughout the city, giving, if possible, their ages and their weights, to give an illustration of how much the mother's care has got to do with whether a baby lives or dies. These photographs have been divided into

four classes, and the first four or five represent babies who were found being brought up on the bottle with ordinary milk, or milk and water, or what we call "saps" in Scotland, which consists of biscuits and other starch ingredients, given of course in carelessness or ignorance of the mother.

The first series deal with bottle-fed children, who were the children of those living in what in Glasgow are called "farmed-out houses." This was another curse of the nineteenth century. Landlords had houses in which undesirable tenants were housed. Instead of letting these houses to the individual tenants, they let the whole tenement or two or three tenements to one person, who paid £4 or so per annum for the rent of a single apartment, and the person put into the apartment perhaps a box or a chair and a bed, and papered the walls often with two or three different kinds of paper, and for that he charged 10d. a night, or 5/- a week, or £13 a year. These houses were occupied mainly by those people who had given way to drink; who had lost their homes, and who having once got into the vortex were unable to get out again.

Pictures were shown of babies of varying weight. One illegimate child six weeks old weighed only 9 lbs., and was now being fed on corporation milk. It might be said that this infant's life had been saved by the corporation. Another illegimate child three months and three weeks old weighed but 9 lbs.

The second series of pictures deal with children fed at the breast, and the weights of these children furnish argument, if argument be needed, that there is nothing for a child like the mother's milk. One child seven weeks old weighed 11 lbs. 8 ozs.; another, twenty-seven days old, weighed 10 lbs. This is one of the most interesting cases I have ever met with. The father was a labourer living in a house of two rooms in the north of the city, and the infant was fed on the breast from birth. The mother had four other children all alive and healthy. She was twenty-nine years of age. The father earned 21s. a week. Although he earned at one time much better pay, as head waiter in a public house, yet owing to conscientious scruples he threw up that job and took a humbler one as a fitter's labourer. Although now in poorer cicumstances the couple said they did not regret the change. I now show a third breast-fed baby of six weeks old, weighing 10 lbs. 8 ozs.; another eight weeks old, weighing 10 lbs. 4 ozs.; and still another seven weeks old, weighing 9 lbs. 12 ozs.

The next series of pictures deal with children fed on Glasgow Corporation milk. Of course, the object of my pictures is to endeavour to show that there is nothing to equal mother's milk, and that respect-

able society ought to deal with smart society, or any other society, which for the sake of the mother's own enjoyment or convenience seeks to deprive the child of that which even the lower animals get. I have taken the trouble to get in the city of Glasgow thirteen well-known, enormously advertised patent foods for babies. I asked our corporation chemist to give the analysis but to keep the names of the proprietors out of my sight, and I wish to show you how it is that our babies do not thrive on a lot of these expensive things, which to some children are little better than poison. In the tabulated statement of the analytical results I have arranged the foods according to the percentage of starch contained in them. From a perusal of the results you will observe that samples one to eight contain over fifty per cent. of starch, and samples one to four contain practically seventy-five per cent. of starch. It is only fair to point out that samples three, seven, and eight contain ferment capable of converting starch into sugar during the preparation of the food for use. No doubt, if the preparation of the food is carefully carried out, it loses a large proportion of the starch which is converted into sugar, but on the other hand, through lack of skill or care, the result may be entirely unsatisfactory, and it is certainly not desirable that the nutritive value of an infant's food should be liable to variations, due to the conduct of the person who prepares the food. Generally the composition of these infant foods varies within a wide radius. For example take the percentage of sugar. It varies between nothing and practically sixty-six per cent.; the percentage of dextrine varies from 1·50 to 14·37 per cent., and the variation of the percentage of starch has been already noted. Fat, an essential constituent in infants' food, varies considerably, and in seven out of the thirteen samples, the percentage is below one per cent. Proteids are a fairly constant figure, but the proportions we have not had time to go into. But the main fact is that the nutritive value of these infant foods placed on the market fluctuates enormously. In some the nutritive value is so low, that if the infant was fed on them without the addition of cows' milk, the result would be starvation.

We say that if mothers cannot nurse their own babies then there ought to be some provision made for these children getting food suitable for them, and we have gone to the length of establishing in Glasgow a corporation milk depot. We have got a highly qualified lady to take charge of it, and coming to this Congress I thought it well to give you an idea of what we are really doing at the present moment. At the present moment we have roughly 800 babies being fed on corporation milk, and the method we adopt is this—we have one large centre in

which we humanise the milk and from this place we distribute it by dairymen throughout the city, and we allow them 15 per cent. for the distribution of our milk as we do not want to become municipal traders of everything under the sun. Recently, we appointed a lady medical officer to follow up the cases so as to get suitable children to take this corporation milk.

I now proceed to show a series of pictures describing the various stages of the treatment of the milk in the central depot. The first shows the entrance, where particulars are taken down and where the baby is supposed to be weighed once a week to see whether it is really thriving or not. The milk is obtained from the same farms which supply the city hospitals, and these farms are subject to the control of the medical officer of health. The cows have also to be regularly tested by the veterinary surgeon to see that there is no tuberculous disease, and so far as we know we get the milk under the best conditions possible. The milk first goes through a separator in the depot for the extraction of dirt which is in milk produced under the very best conditions. The bottle washing machine is a new idea, for the girl who attends it is bound to wash the bottle for her own preservation. Each bottle is washed three times. All the girl has to do is to place the bottle on the machine and if she neglects to do so she gets drenched. The machine washes 2,000 bottles per hour. After the bottles are washed they are filled with milk to an exact measure. They charge 2d., 2½d., and 3d. for the milk, and the corporation went into it deliberately knowing that they would lose money, in order that it might not be thrown at them that it is a money-making concern. They have a metallic cork for every bottle, which keeps the milk in absolutely splendid condition. After the bottles are filled they are run into a steriliser, and afterwards they go into a refrigerator. Subsequently the milk is distributed in carts bearing the name of the corporation.

A series of views of the playground provided for the children of the city will now be thrown on the screen.

Well, what is to be done? Is Britain going to sit still and let us go on for a few years more before doing something to stop this great waste of infant life. I am not here to argue that food will solve the problem, but I say it is one of the most important factors of the problem. There are many others; and I want, if it is possible, some influence to go from this meeting by the delegates to their respective authorities, so that we may by importunity make the Government know that we are determined to have this gross scandal removed. I admit that I am not politically orthodox: I do not understand at all the ways of Government. I

think I might have been in Parliament if I had wished, but I am very glad I have not gone in. What is it we find the Government taking up their time with?—the Wild Birds Protection Act; the Fresh-water Trout Bill; the Hares and Rabbits Bill. Well, I am only a plain man, but if I were asked to solve these problems I would say that the man who wastes his time fishing a stream should have leave to keep all the fish he gets. Last week I was in a committee room, and what did I find the gentlemen doing? They were discussing the Fertilising and Foods Bill. The idea was that the proprietors of fertilisers should not cheat the ground; and yet to-day the proprietors of infants' foods may make as much profit as they like, regardless of what the result is to be to the children.

We have Boards of Agriculture, and I do not object to them wanting to know how to preserve fish life and how to kill the big bug; but the greatest thing we have to do is to conserve life. We have also through our sanitary associations to see that the people get pure food and decent houses and one or two other things; and yet to-day they are busy discussing, in the law courts, what is whisky? I want to get this Congress enthusiastic, so that they might go home and consider what is infants' food, that we may make representations to the Government that something may be done to help us by legislation in putting an end to the terrible wastage that is going on.

What I suggest is, first—and again I am afraid I am heterodox—I do not object to girls being well educated and trained in everything which is to be a benefit to them, but I think if instead of cramming their heads so that they may perplex their mothers and fathers with educational conundrums, it would be a good thing if teachers found at least a little time to teach the girls something about invalid and infant diet and cooking. I think some representation should be made in that direction.

In the second place, what we must have without delay is notification within forty-eight hours of the birth of every baby. In Glasgow we tried to bribe them by offering one shilling to every person who would bring information, but it would not do. What I do not understand is that while a death has to be registered in three days, a birth in Scotland may not be registered for three weeks, so that it very often happens that the Registrar is asked to register the birth and the death at one visit. I hope that we shall go away from this place determined that notification to the medical officer of health should be made within forty-eight hours.

In the next place, I think that the law ought to be enforced so that mothers will not be allowed to work in factories up to the very hour of their confinement; and in the next place, I think that mothers ought not

to be allowed to resume their work after their confinement until they have satisfied the medical officer of health that they had made proper provision for the nursing of their little babies left at home.

Then again we want to put an end to the scandal which at present exists with still births. At the present moment we are told that children are born living and are allowed to die. We want every birth, whether it be a live or a still birth, to be notified, and that no child still-born shall be allowed to be buried until it is first seen by the medical officer of health.

These are the important points which I think we ought to deal with. I will not weary you further, but will close with a few lines that were sent me by one of my officials on having seen an infant dying in a herring box, knowing that I was going to address this Conference:

> "O sweet, unconscious martyr! I have seen
> Thee slowly dying, with no help at hand
> But hers who bore thee, and have watched the sand
> Of thy brief life run out, who might have been
> A priceless jewel in thy native land.
> As bleating ewe upon the upland green
> Whose wandered lamb lies dead in a ravine,
> Thy mother cries—but does not understand.
> Dear God, forbid it that the coming years
> Shall see such infants sinking in the deep
> Unaided, lost, . . . and Science looking on.
> Ah, no! responsive to maternal tears,
> Behold! Britannia rises from her sleep
> And from the cradle bids pale Death begone."

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

WATERWORKS.—*Injurious affection of Land Loss of Support—Authorized Working—Compensation—Interest—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17), ss. 6, 12.*

By a special Act which incorporated the Waterworks Clauses Act, 1847, the defendants were authorized to make and maintain certain waterworks, including a well and pumping station. After the completion of the works the defendants, for the purpose of their undertaking, took, by means of pumping operations, such water as was found in and under the lands taken by them for constructing their works, and in so doing caused damage to the plaintiff's premises by the abstraction of a bed of wet running silt which formed the subsoil and support of the plaintiff's land. In respect of the damage thus sustained the plaintiff claimed compensation under s. 12 or s. 6 of the Waterworks Clauses Act, 1847, and, an arbitration having been held, was awarded compensation by the umpire. In an action by the plaintiff to recover the sum awarded and costs and interest:—

Held, that the plaintiff's premises had been injuriously affected; that s. 12 empowered the defendants to take water not only for the purpose of the construction of the authorized works, but also, after their completion, for the purpose of the undertaking, and that compensation was, therefore, payable to the plaintiff under s. 12; that, assuming the power to take water after the completion of the works was derived from the special Act, and not from s. 12, the plaintiff's premises had been injuriously affected by the exercise of the powers authorized by the special Act, within the meaning of s. 6 of the Waterworks Clauses Act, 1847, so as to entitle the plaintiff to be paid compensation under s. 6.

Held, also, that interest at 4 per cent. from the date of a demand in writing was payable on the amount of compensation awarded and on the taxed costs.

The rule of construction of Acts of Parliament that the effect of words, perfectly clear in themselves, is not limited by general words in a preamble applies equally to the heading of a section.

FLETCHER *v.* BIRKENHEAD CORPORATION. Bray, J. 1 K.B. 605.

Volume XXVII. No. 8. Issued September, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONGRESS AT BRISTOL.

SECTION I.
SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By SIR WILLIAM J. COLLINS, M.P., M.D., M.S., F.R.C.S., B.Sc., D.P.H.,
PRESIDENT OF THE SECTION.
(FELLOW).

IN welcoming members of the Congress to a consideration of the important problems which will engage the attention of Section I., allow me, in acknowledging the compliment of placing me in the Presidential chair, to assure you that I shall not abuse the privilege by inflicting upon you a long-winded presidential address; for even if I harboured any such malevolent intention, the exigencies of the numerous public and professional duties in which I am absorbed would have effectually militated against so ungracious a reciprocation of the courtesy which has been extended to me.

Of the Congresses and Institutes innumerable which annually foregather and celebrate I can recall none that can surpass in its aims for the physical betterment of the masses of our countrymen the one which this week celebrates its three and twentieth anniversary in this capital of the West. This Institute exists alike to *promote* sanitary knowledge and to *diffuse* it. It is at once an agency for production and distribution. It invites to its Councils and Congresses with impartial solicitude, architects and engineers, municipal representatives and medical officers, expert specialists and intelligent laymen, those who inspect and those who suffer inspection, social workers both of the fair and unfair sex, the leisured

classes and the labouring classes; all are united as co-workers in building the Temple to Hygeia, all enrolled under the common banner *Sanitas, Sanitatum Omnia Sanitas.*

Of the three sections into which the work of the Congress is codified, two deal almost exclusively with conditions which may be termed environmental. That is to say the means whereby the ancillary sciences of Physics and Chemistry, and the applied arts and sciences of Engineering and Architecture serve to secure that the *entourage* of mankind shall be healthy and so contrived as to keep at bay the causes of disease.

This Section No. 1 deals with Sanitary Science and Preventive Medicine and thus introduces a biological element. It scrutinizes not only the environment, but it has regard also to the powers resident within the body which do battle with disease and make for health.

It investigates that *Vis medicatrix Naturæ* which puzzled the humoural pathologists of old as it perplexes the bacteriologist of to-day. Just as in the past the quest of the alchemist was the *Elixir Vitæ*, so now the less ambitious search of the phagocytosist and the opsonist is to discover and exalt means whereby the native powers of healthy blood may catch and cook the invading hordes of noxious germs.

I know not why this section should bear the double-barrelled name of Sanitary Science and Preventive Medicine. That the two are one and the same has ever been a favourite theme of mine.

The reciprocal influence of man and his environment, the due recognition of the influence of the soil as well as of the seed, of the *rôle* of the tissues and blood of the body as well as of the life history of the parasites which may fortuitously invade its integrity, the bactericidal power resident in the healthy norm, these are parables on which I have preached repeatedly during the last quarter of a century.

In 1884, at St. Bartholomew's Hospital, in a paper on "Specificity and Evolution in Disease" (which gained the approbation of Herbert Spencer), I brought forward a collection of observations gleaned from reports of medical officers of health and other sources, which led me to conclude that diseases usually accounted specific have under certain conditions arisen independently of contagion, that is to say *de novo;* that divers diseases may own a common external ancestry; that the same poison may produce different results in different individuals; that specificity depends largely on the soil on which the seed is sown and on which it is subsequently cultivated; that the property of contagiousness or infectiveness dormant in every inflammation and fever increases in proportion to specificity, in proportion to successful cultivation on suitable soil; that there is in disease

as in all nature a tendency of the common to become the specific, the homogeneous to give birth to the heterogeneous, and that the distinctive characters of the acute infectious diseases may well have been built up as it were, from some ancestral common fever. And on the other hand that the relations of the specific fevers to common fever have their parallel and counterpart in the relation of specific local inflammation to common inflammation; and, further, that under the head of Nondescripts or anomalous diseases, we are dealing with natural variations of species under cultivation. That mongrels and hybrids are results of intermixture and crossing of species, and all such like, instead of standing apart from the rest as incongruous and inexplicable, under evolutionary views will fall in, in perfect harmony and order.

At the meeting of this Institute held at Worcester in 1889 I further developed this thesis, and dealt with some of the criticisms which it had evoked. I pleaded that the paramount importance of soil had been absurdly underrated as a determining factor in specificity, and indeed, in pathogenic property altogether. Witness the bacillus of mouse septicæmia, which is uniformly fatal to house mice within three days, yet is harmless to field mice. Again, while goats, hedgehogs, sparrows, horses, cows, and most breeds of sheep are susceptible to inoculated anthrax, dogs, cats, white rats, and Algerian sheep are naturally immune. Again, disturbing conditions may bring about a susceptibility in the habitually unpredisposed, as is shown by the fact that fish and frogs, which are normally unaffected by anthrax, are infected if their temperature be artificially raised.

Bacteriology, I said, has doubtless done much for pathology, but it has done much less than scientific persons both in and out of the profession are apt to imagine.

That the growth of fission fungi in the body has been closely associated with certain forms of disease may be readily conceded, and the two great facts of self-multiplication and contagion suggest that the *materies morbi* of infective diseases should be biological rather than chemical. Yet as in the case of tubercle, what a potent factor is the soil on which the seed is sown, to nullify, to countervail, and to arrest.

As I urged fifteen years ago, the limited acceptance of the germ hypothesis is in no sense inimical to these views.

Since, if it be true that in the life history of the lowest of organic things lie the momentous influences which may determine plagues and pestilences, it is reasonable to believe that in organisms whose cycle may be less than an hour and whose rate of propagation is incalculable,

evolution must be powerfully at work eventuating in the survival of those most fitted to their environment; and that in this as in other directions man's influence may modify natural selection, so that by acting in accordance with law we may learn to conquer Nature by submitting to her.

In the popular lecture which I delivered at the close of the Sanitary Institute Congress, at Manchester, in 1902, entitled, "The Man *v.* the Microbe," I restated my contention and traced a tendency in recent years to concede a larger and larger share to the soil and a less and less dominant influence to the microbe than had been sanctioned by the orthodox view obtaining in the latter half of last century.

The venerable Lister has allowed that "a new and surprising light has been thrown upon the means by which the living animal defends itself against the assaults of noxious organisms from without." Dr. Dickinson, of St. George's, in a recent lecture, observed, "in these days of applied science and adventurous medicine it is necessary to preach caution, lest we have too much thought for the microbe and too little for the man." Sir Stephen Mackenzie protested against the same tendency, and added, "We must never forget that the soil is of as great importance as the seed in the proper understanding of diseases of microbic origin." Four years ago I maintained, "It would be not far from the actual truth to say that we have been living under the dominion of the Bacillus. That blessed word has met us at every turn, and shadowed us in every department of public and private life. The germ has, perhaps, been too much with us, and we have, perchance, sometimes lost sight of the man amid the luxuriant and magnificent flora of the bacteriological laboratory. We cannot see the man for the germs. Let me not be misunderstood; I do not wish to speak with disrespect of the deadly bacillus, or even of the lowlier micrococcus. I have been at pains to cultivate them in my laboratory, have patiently studied their developments in innumerable test-tubes, on a variety of delicacies suited to their fastidious tastes, and have examples by the gross of their infinite varieties, duly stained and preserved, and labelled with a nomenclature well calculated to overawe the vulgar, or serve the purposes of a commination service." It is against the too-exclusive consideration of bacteriology that I raise my protest.

Since I spoke at Manchester I have received further corroboration. Thus, in a recent work on Bacteriology and the Public Health, Dr. G. Newman, Medical Officer of Health for Finsbury, says: "It is of essential importance to the right understanding of the rôle which bacteria play in the production of disease to give full place to the part taken by the soil on which they are implanted. Few ideas in bacteriology are more

erroneous, or likely to lead to graver misconception, than to suppose that bacteria produce the same effect under all conditions, and that the human tissues play a small part."

He alludes to the earlier school of preventive medicine which emphasised "predisposition," and the later school which emphasises the "bacillus," and asserts "the truth is to be found in a right perception of the action and inter-action of the tissues and the bacillus." Thus a certain bacillus, he says, in A's throat sets up diphtheria; in B's throat it is quiescent, producing no apparent disease. "The cause of this extraordinary fact may be a question of different virulence in the two bacilli, but is *more likely* to be due to the greater vigour in B's throat. Which is the more important preventive method, to maintain the resistance of the individual or to waylay the infecting organism, is a nice point we need not attempt to decide. Obviously, both objects should be kept in view."

Dr. Newman, in sending me a copy of his able book, was so good as to write me: "I have tried to learn the lesson you used to emphasise—the relativity of bacteriology and its tentativeness. I have also used your ideas of seed and soil in Chapter I."

He concludes, "The advance of bacteriology has been so rapid and marked by such striking discoveries that there has been a tendency to over-rate altogether the potentiality of the bacillus apart from its medium. The latest findings in comparative culture work, of immunity and the production of anti-toxins have, however, demonstrated beyond all doubt the enormous part played by the medium or soil in which the micro-organism is growing."

The same author, who has studied disease not only in the test tubes of the laboratory but also in the slums of Clerkenwell, then refers to the specificity of bacteria and says, "It must be remembered that species are merely arbitrary divisions which present no deeper significance from a philosophical point of view than is presented by well-marked varieties, out of which they are in all cases believed to have arisen and from which it is often a matter of individual opinion whether they shall be separated by receiving a specific label." He illustrates this thesis by referring to the cases of the bacilli which have been identified with typhoid fever and diphtheria respectively, showing how the morphology of each may vary in different soils and in different strains and present appearances which render them almost, if not quite, indistinguishable from other organisms which are not ordinarily disease producing, *i.e.*, are not pathogenic.

He is led finally to agree with my conclusions of 1884, and asserts that it is not improbable that the views of the early bacteriologists will have to

be very much revised, and that eventually it will be found that many species of micro-organisms are in reality varieties of a single species showing involution and pleomorphic forms.

Likewise Dr. Nash, medical officer of Southend, also an accomplished bacteriologist, in the *Lancet* of January 7 of last year, states that his study of infectious diseases has led him to a confirmation of the views advanced by me so many years ago as to the importance of the "part played by evolutionary factors in disease processes."

It was, according to Sir John Simon, something of a reproach to the old Board of Health and sanitarians of the Chadwick type that "in their perfectly proper zeal against filth, they immensely under-rated, not to say ignored, the independent importance of the morbid contagia," and that accordingly "the doctrines they promulgated on the subject of epidemic infection have long since been made obsolete by the advances of exact knowledge." Now, it is impossible to read the doctrines of the sanitarian school as enunciated by Chadwick, Southwood Smith, Richardson, and men of that stamp, and compare them with the more modern and fashionable doctrines of the school of thought associated with the names of Pasteur and Koch, without realising that we are in the presence of two different and, to some extent, conflicting views of the nature of disease, and of the methods of disease prevention. The former is imbued with the potency of such factors as go to make up environment, pure air, pure water, refuse-removal, personal cleanliness, the fortifying of the individual against all attack from without upon the integrity of health. The latter, intent upon the microscopic causes of contagion, relying upon analogies drawn from the process of fermentation, is bent on conferring immunity upon the individual by establishing within him a condition of insusceptibility which will enable him to resist successfully the assaults of his unseen foes, the circumambient microscopic germs. It always appeared to me that the narrow bacteriological view was open to the charge of ignoring in pathology the work of Darwin, Alfred Russell Wallace, and Spencer. As Simon condemned the early sanitarians because "in their perfectly proper zeal against filth they immensely under-rated, not to say ignored, the independent importance of the morbid contagia," so I would venture to suggest that some of our modern would-be reformers in their perfectly proper zeal against bacteria are in danger of immensely under-rating and even ignoring the potency of filth and removable conditions as factors in disease production and propagation. From the conflict of these two schools of thought the truth is slowly emerging, and so far from the "sanitary idea" of Chadwick being a dis-

carded relic of the past, it is destined to be the established doctrine of the future. He foresaw and justly estimated the coming conflict between these two schools of thought, and in the evening of his days shrewdly recorded his opinion in these words:—"Presuming that the advocates of what is called the germ theory of disease could sustain their case, it is still believed by many observers that a predisposition or nidus in the affected person must exist before the exciting influence can take effect."

The late Professor Virchow held very similar views to those of Chadwick. In 1881, at the International Congress, he asked the significant question, "In what relation does the infecting organism stand to the cells of the living body?" and he boldly proclaimed his opinion that "the old doctrine of predisposition to disease, which might seem to be antiquated, would gain a new basis," and he prognosticated that "we should come back to the old doctrine of weakness and strength as explaining liability to disease, of which he had always thought highly." On the occasion of this grand old man of Berlin's last visit to this country to deliver a lecture on pathology, I had the pleasure of meeting him, and I said at its conclusion, "Allow me to congratulate you, Professor Virchow, on having succeeded in delivering a lecture on pathology without mentioning the bacillus," and he replied, with a knowing smile, "Ah! he is taking a smaller place."

It is not surprising that this should have been the ripe opinion of the author of the cellular pathology. We have expected too much from bacteriology, and have rather neglected the inherent properties of the cells and tissues of the body alike in the production of and protection from what we rather loosely and collectively speak of as disease. Back to cellular pathology we must go, but to a cellular pathology interpreted and quickened by the loyal acceptance of the evolutionary principle. By the path of comparative pathology we must study the concourse of differentiated cells which make up a multicellular organism in its simplest expressions and in its phylogenetic relations. The potentiality of the amæboid cell, both for weal or woe, will thus be elucidated. The rôle of the phagocyte and the genesis of cancer become manifest, as I have endeavoured to show elsewhere. We must remember that we are "the heirs of all the ages," of the lowly amæba as well as of our parents.

In inflammation, repair, and in malignant growths, then, there is a reversion to embryonal cell type. In the former two processes there is either organization of embryonal cells into tissue or liquefacation into pus. In the neoplasms, on the other hand, there is indisposition of the component cells either to differentiate into tissue or to suppurate. They

lack the influence which makes for organization, are reminiscent of reproductive cells, while their instincts are of the lowest, amœboid in fact. They possess the fecundity of cells unfitted for "colonial" life, and share their vagabond propensities. Herein lie the factors of malignancy, the causes alike of rapid growth and the infectivity of cancer.

On the other hand there is a brighter side to the picture; whether by the agency of the leucocytes or by chemical action healthy blood is found to be a potent germicide, a disinfectant and prophylactic when invasion of the body has been effected.

It is, however, the business of the sanitarian to prevent such invasions taking place, to see that the battleground is kept outside rather than inside the body, and, as is the aim of modern surgery, to prevent all infection from without by purifying the environment. In plague, in cholera, in typhoid, in leprosy, in tubercle the lesson has been and is being learnt, and in each case where the appropriate sanitary remedy has been applied the pest has been stayed or controlled. True the war against tuberculosis, the white man's plague, is as yet but ineffectively waged. Koch was right when he said, "It is the overcrowded dwellings of the poor that we have to regard as the real breeding places of tuberculosis; it is out of them that the disease always crops up anew, and it is to the abolition of these conditions that we must first and foremost direct our attention if we wish to attack the evil at its root and wage war against it with effective weapons." How true this is none know better than some of us who have been engaged in rooting out the rookeries and wiping out the plague spots which have too long disgraced the civilisation of our great cities.

As with the Aseptic Surgeon, so with the true Sanitarian, his aim and duty is, as one of the early fathers of this Institute (Dr. Alfred Carpenter) used to teach, "To seek to remove from our persons and our habitations the *débris* which arises from the act of living, and the removal of which would render us proof against the evils caused by contagion," or as another pioneer (Sir Benjamin Richardson) more generally stated the same thought when he said, "Purity of Life is all-sufficient to remove what exists without invoking what is not." His city of Hygeia may still be to us as it were a dream; but the hopes of the Hygienist are not less justified nor the teaching of the Sanitarian less needed when we review in the light of the latest science and the most modern practice the principles which should guide the pathway of Preventive Medicine.

THE HEALTH VISITOR:

FROM THE COUNTY COUNCIL POINT OF VIEW.

By Prof. BOSTOCK HILL, M.Sc., M.D., D.P.H.Camb.
(FELLOW.)

ABSTRACT.

I HAD been familiar for some years with the work done by the staff of health visitors in the city of Birmingham, and had gradually become convinced that there was work to do of an important kind, and which could only be done by women holding a sanitary qualification. I was so convinced of the importance of the work, that some time after my appointment as County Medical Officer of Health for Warwickshire I determined to see if it were possible to do similar work in the smaller urban and rural districts, of which the county is made up. At the outset, I was confronted with certain difficulties. The County Council, as at present constituted, is not, ordinarily speaking, a sanitary authority, and the work of sanitation in the counties is done by district councils and their officers, who are only indirectly under the control of the county council. In a city or town the health visitors are appointed by the sanitary authority; they are sister officers of the ordinary sanitary staff; but in the counties, if they be county council officials, they must be outside the sanitary staffs of the district in which they work. This at once is liable to introduce a feeling of jealousy in the minds of the district officers, which of necessity makes the conduct of the work in the district difficult; but I am pleased to say that in the great majority of instances personal considerations have not been allowed to enter, and very little difficulty has been experienced in Warwickshire on this account. It might be urged that the difficulty could be met by making the health visitors the officers of the district council, but when we consider that at the present time all the larger county districts are under-staffed as regards normal inspection, and when we consider also the difficulty of getting increases of the staff, it will, I fear, take a considerable education in the needs of sanitation before district authorities consider it advisable to spend money in this way. In Warwickshire I

commenced tentatively, and as a result prevailed upon the Sanitary Committee of the County Council to appoint one health visitor. Many of the members of the committee took great interest in her work, personally as well as officially, and as a result they became so convinced of the importance of it, that another was speedily added to my staff. In about a year's time the staff was again doubled, and at present the county is divided into four districts (North, South, East, and West) with a health visitor in each district; so that periodically every portion of the county is visited in turn.

Speaking with some experience of the sanitary administration of every kind of district, I have no hesitation in stating that the need for health visiting is equally great in country and in town. While it is true that there is not the same overcrowding on space, and while many of the debilitating influences of town-life are absent in the country, yet the same, or a greater ignorance prevails of elementary physiology, and of the proper methods of feeding and rearing children. While also it is true, in many instances, that life has to be spent in dwellings more incompatible with healthy existence than the majority of those found in towns.

As regards qualifications, I attach the greatest importance to this, the visitor must be well educated, and, to have the fullest influence, should be patient and refined in manner. I am convinced it is a mistake to suppose that more effect is produced by women of the cottager type than by competent and well educated women. It is desirable too that the visitors should have had some experience of general nursing, as then they are able in many instances not only to help, but to gain the confidence of cottagers, by advice and assistance in many little matters. They also should have a good knowledge of general hygiene, and it is desirable, therefore, that they should possess the certificate of The Royal Sanitary Institute, or the diploma of the National Health Society. If they have had experience in teaching hygiene, both by precept and example, so much the better. It might be thought, at first sight, that for the salary offered, such qualifications would be hard to find, but as a matter of fact it is not so, and there are plenty of excellently qualified women eagerly seeking for posts as health visitors.

As regards their duties, their main function is undoubtedly the bettering of the conditions under which children are reared. To do this, they must first of all gain the confidence of the mothers, and gain entry into their houses. To a large extent this is a matter of tact, and an ex-

perienced health visitor, as a rule, has but little difficulty in a very short time in ingratiating herself with the people among whom she works, so that she is regarded distinctly as a friend of the family. In some instances, of course, there are difficulties. These may arise from ignorance, or from a fear that the health visitor is an inspector rather than a visitor, and frequently from the meddling interference of those who ought to know better, who advise the women not to allow the visitors in their houses, for fear they may discover sanitary defects, and that expense would be put upon the property owner. I have known instances where this has been done by small owners of property, and also by estate agents, but I am glad to say that the cases are few and far between. If possible, it is desirable, too, that the health visitor should be favourably received by the clergyman of the district in which she works. In the country the clergy have a very powerful influence, and if they use this in favour of the work of the health visitor, in many instances much help is afforded. For instance, I have known good result from the minister calling the women together to meet the health visitor, so that she may have a provisional talk with them. If there are philanthropic people who reside in the district, their aid should be requisitioned; while it is desirable, too, that the help of the district sanitary officers should be obtained.

Having gained the confidence of the cottagers, her chief function is, as I have before stated, to endeavour to deal with the problem of infant rearing, and at least to do something to check the terrible waste of life, that veritable massacre of the innocents constantly taking place throughout the country. Statistics show that during the last thirty years (the period since the Public Health Act was passed) a constant improvement has been effected in the public health; but it is also a lamentable fact, now fully recognised, that the improvement has been effected in persons living at all ages except in the first year of life. In other words, up to the last year or so the rate of infant mortality has remained practically the same since 1875. This matter has been much discussed and written upon. That the public conscience is being aroused is shown by the fact that at the recent Conference on Infant Mortality, the subject was very fully discussed by many competent people, while the President of the Local Government Board showed his sympathy and concern by acting as President of the Conference, and giving a Presidential Address, dealing with this subject in a scientific and statesman-like manner. When we consider the statistics of the various communities, we can see that the lowered mortality has been effected chiefly by what I may term sanitary

improvements on the large scale effected by governing bodies, as well as to some extent by the general betterment of the condition of the working classes. A further examination of available statistics shows that the terrible toll of infant lives is paid chiefly by the working classes, while an examination of the causes of death shows that a large proportion of the mortality is preventable, and is due to ignorance of those conditions on which the welfare of infants depends, and this being so, it is obvious that the competent and sympathetic woman has a great field for her labour.

In Warwickshire the health visitor, on gaining the confidence of the mother, endeavours to correct any misapprehension the latter may have as regards feeding. She has in her possession leaflets, issued by the Sanitary Committee of the County Council, and drawn up by me, urging where possible the advisability of breast-feeding, and where this is not possible, the avoidance of all those patent foods and other abominations so much beloved of the working classes. At the same time instruction, often much needed, is given as to clothing and washing of infants, and the necessity of doing all that is possible to increase the ration of fresh air in all the rooms of the house. As they are well versed in the sanitation of buildings, they take notice of any defects they observe, such as stopped drains, uncleanly closets, bad paving, dampness of houses, windows that won't open, stopped-up chimneys, and general uncleanliness of the place. This they report to me in confidence, and at the same time, having previously obtained the expressed desire of the medical officer of health, they send to him, or to the inspector of nuisances, a list of the defects. In this way I have known in certain districts an immense amount of sanitary work done. The inspector in a large rural district has not the opportunity of making frequent visits to all parts of the district, and it is very satisfactory to be able to state, that in the great majority of instances I find that they hail with satisfaction this further means of obtaining an insight into those conditions inimical to the health of the people. On two occasions during 1905 I sent health visitors to do, with their own consent, special work in certain districts during times of epidemic. In one case where smallpox broke out in a small town, one of the health visitors won golden opinions by the work she did, chiefly by persuading the anti-vaccinating section of the community to avail themselves of the benefits of vaccination, while she was able to discover many unsuspected cases owing to the opportunity she had of visiting the bedrooms where patients were ill, of course, with the consent of the householders. In the other case, the district medical officer of health spoke in the highest terms of the work done in a localised epidemic of scarlet fever in one or two straggling villages, in

discovering unsuspected and doubtful cases and getting these isolated, thus preventing the spreading of the disease. I need hardly add that I consider this is really outside the ordinary health visitors' work, and while they are helping a particular district in this way they are not doing any of their ordinary visiting.

Another important work which I have instituted in Warwickshire is the giving of Health Talks at the schools. This of course is done with the full consent of the Education Committee, and of the local managers and teachers; and I am inclined to think that it is perhaps as fruitful as any other sanitary work. When a health visitor goes for a period into a district, having been previously armed with an authorization from the Director of Education in the county, she arranges with the head master or mistress to give short talks on common subjects appertaining to health, such as: "Fresh air," "The skin and cleanliness," "The prevention of consumption," "The hygiene of the house"; and to the elder girls, "The feeding and care of babies." This work is popular among the children, and I have a large collection of papers written by them, many of which show, for the age of the scholar, an extraordinary appreciation of what they have heard. (Here Prof. Bostock Hill quoted one or two examples from the written papers of children of different ages, showing that they had picked up the chief points of the talk.)

As an illustration of the large amount of work done in this way, one of the lady health visitors in the first half of this year gave no less than fifty-six health talks. It must not be supposed that the knowledge conveyed is always, or even in a large majority of instances, fully acted upon, but I have ample evidence, from head teachers among others, that after the visits of a health visitor in a rural district, the general condition of the children attending the schools is markedly improved. It may be urged by some, that such a type of instruction is not scientific, and that therefore it is mistaken. The suggestion may be true, but the conclusion is false. Having had twenty-five years' experience of teaching hygiene to every kind of audience, from university work downwards, I am convinced that more good is done in elementary schools by a homely simple talk on healthy living, than by any extended syllabus scientifically considered. We do not want to unnecessarily cram the minds of elementary school children further than at present, but if we can get them to appreciate themselves, to see that if they adopt the doctrines of cleanliness in their bodies, in their food, in the air they breathe, and in their houses, they will live longer and happier lives, we are doing that work which is so essential to future advance.

Another department of work which I have established, is the visiting the houses where children have been newly born. With my present staff I cannot carry out this fully, but in one particular district of the county one of my health visitors has of late been doing good work in this way. It is particularly useful in the case of young mothers.

I have also drawn up leaflets on "Advice to Householders," and on "Consumption." These the health visitors leave, and explain under suitable conditions, and I believe they are productive of considerable good. In many instances, where a consumptive is in the house, people are very willing to receive, and very grateful for, advice how best to deal with the patient with the least risk to themselves.

In Warwickshire, too, I have originated another form of work for health visitors, the inspection of midwives and their kit. In counties it is essential that the executive officer should be the county medical officer of health, but that the actual inspection of the midwives' instruments, kit and records, should be done by competent women. Two of my health visitors are trained midwives. The others will undergo training in due course, arrangements having been made by the County Council for that purpose. There are many reasons why I consider the utilization of health visitors advantageous in county areas. One of the difficulties of administration is the long distance to be covered between the villages in many instances. In Warwickshire we have 336 midwives, and it is obvious that by the nature of their occupation many of these will be away from their homes at times. This makes inspection somewhat difficult, but if the opportunity to inspect them is taken by the health visitor when working in the neighbourhood, a large amount of time and money expended in travelling is saved, while a much better supervision can be effected. In addition to this, the work of the health visitor can be utilized in discovering the newly-born babies, while with care and tact she can make the midwives, in many instances, her allies in the crusade against improper infant treatment, and in this way further effect her purpose.

I hope I have been able to show that in the smaller districts of the country there is a vast field of labour for the qualified and tactful health visitor. Personally I have very strong convictions on the subject. I firmly believe that, though so much has been done in the past by the sanitary authorities in lowering the death-rate and improving the sanitary conditions of the masses, by improving water supplies, devising schemes of drainage and sewerage and such like works, yet that the chief work of the future will be more associated with the home-life of the people, making

them understand that happiness is largely a question of health, and that this can be obtained only by the observance of the simple but rigorous laws of nature; in fact, that a happy and healthy life is only possible where the doctrine of cleanliness is practised, cleanliness, that is, of air, water, food, and home. If this be so, then this advance must be carried out by women, partly in the home and partly in the school; women whose advent must be hailed as ministering to health and happiness, and therefore to whom the doors are always open wide. If this were all it would be a wonderful and merciful work, but there is more behind. As a nation we have had a remarkable history. In the race for wealth, up to now, we have had hardly a rival, but is there not, to those who can read the handwriting on the wall? Must we not see that the diminished production of children of late years is a national danger, and that if we are to maintain our position as a world power, it must be by a struggle for health, as well as for wealth? Must we not, therefore, do something to stay the plague which ruthlessly, year by year, robs us of so much potential force? Must we not by every means in our power strive to diminish the ignorance and prejudice, on which our excessive infant mortality so largely depends? The human element must always remain the chief factor in power, and therefore I plead for a conservation of our national force, which at the present time can be best maintained and increased by the ministration of the health visitor in the country as well as in the town.

Alderman E. S. Hindmarsh (Gateshead) thought if something could be brought home to prevent juvenile smoking, and also to curtail the amount of drinking by nursing women, that great good would accrue. While thanking Dr. Hill for his excellent paper, he would urge that more attention should be paid to the teaching of hygiene and temperance in our public schools.

Dr. F. Vacher (Cheshire C.C.) said that he was interested in Dr. Bostock Hill's scheme for supplying Warwickshire with lady health visitors. He did not know under what powers these visitors were appointed. He concluded that these women had not been appointed till after the passing of the Midwives Act, 1902, and that they were primarily appointed as inspectors under the Midwives Act, and were given additional duties as health visitors.

Miss M. Keith Dowding (National Health Society) said she believed in teaching the mothers in hygiene more than the children; they did not like

being told things by their children. It made the children rather insubordinate, too, to be set to teach the parents, or to "teach their grandmother." They knew so much more than their parents now, they got to look down on them. The mothers were anxious to learn, preferring to be taught themselves, as they say they can make nothing of what the children bring home.

Dr. James Robert Kaye (West Riding C.C.) referred to the value of the health visitor, and agreed with the importance of "talks" to mothers, especially in courtyards. As to their use in midwives' inspection, he thought it was most advisable to have the midwives visited first of all by a medical man, and the routine inspection afterwards carried on by ladies.

Miss L. Swallow (Warwickshire C.C.) said it was necessary for health visitors to visit first and preach cleanliness of person, kit, house, etc., and medical practitioners to visit afterwards. Much could be done in regard to the house management, etc., through giving health talks to the children at school. An amount of good could be done by giving simple health talks to the people of both sexes in the villages. She gave a few instances of results of her work in rural districts.

Sir Charles Cameron (Dublin) said that he was an earnest advocate for the employment of lady sanitary officers. He had induced the Corporation of Dublin to appoint four lady sanitary officers. They had made a reformation in the sanitary condition of the homes of the poorer classes. They had given great attention to the dieting of children. In Dublin, infants of the most tender age were given bits of every kind of food used by the family; you might see a piece of fat bacon in the mouth of a three months' old infant. Separated milk, wholly deprived of fats and condensed, was until lately largely given to children. Sir Charles explained that the boiling down of milk and the removal of its fat deprived it of nearly all its valuable qualities. The lady sanitary officers had reduced the consumption of separated milk by infants to a minimum. A large amount of disease was caused by the want of cleanliness of rooms, clothes, and persons, amongst the poor. Better hygienic knowledge was now being imparted to them with good results. In conclusion, Sir Charles, as an out-and-out woman's righter, advocated the principle that women who did the same amount and quality of work as man should be equally well paid.

Dr. William Butler (Willesden) had been greatly impressed with the value of the health visitor's work in his own district. The advent of the lady health visitor was the most valuable addition to public health administration. The greatest obstacle to health progress in this country was woman. Her

ignorance as housewife, her incapacity to rear children in accordance with hygienic requirements or to manage her home so that its régime is consistent with health was an obstacle to sanitary progress which far outweighed in importance others to which attention was still largely directed. In housing, for instance, the authorities were for the most part ahead of the inmates in the attainment of conditions consistent with health. It was for this reason that the health visitor was to be especially welcomed. In instructing the mother how to rear her offspring she would do much to reduce the mortality, which, as Prof. Bostock Hill had pointed out, had not been materially diminished. The value of the health visitor's work, however, would be diminished, her interest in it would necessarily decline, unless it provided a variety extending beyond the question of infant rearing. Woman was naturally inquisitive, and he had found the health visitor peculiarly fitted to carry out inquiries into the cases of zymotic disease which had to be investigated. At the same time he thought it important that her work should be kept distinct from that of the sanitary inspector.

DR. JOHN CLARE (Hanley), as medical officer of health of a county borough which had employed as health visitor a qualified lady medical practitioner, said that he could testify to the very useful work done. Better done by a well-educated woman than by one of an inferior status, but advice cannot be carried out where, as in Hanley, the married women go to work, and are often the breadwinners for the family.

MISS LOWE (Warwickshire C.C.) said that the chief work of the health visitor was infant rearing, and mentioned a case of a baby of eleven months fed solely on bread and tea. Health visitors were *not* inspectors, they went as friends of the people.

DR. ELIZA DUNBAR (Clifton, Bristol), said that the lady health visitor, it seemed, must be highly educated, refined, full of tact, pleasant looking, and strong. Such a woman should be well paid, and her salary should be sufficient to include the possibility of keeping a pony or a pony trap, for, in the testimony of a lady health visitor, there is an immense amount of walking to be done. At present the salaries are very inadequate.

MISS EDITH M. EVANS (Nottingham) said that if women were the obstacle to a healthy life, women health visitors should be the remedy. Nottingham had applied for their number of health visitors to be increased, four more to include visitors for maternity cases. Applications had been received from hospitals for out-patient visitors, especially for consumptive cases.

Dr. H. Meredith Richards (Croydon) agreed with Prof. Bostock Hill that the health visitor should be an educated lady, and was inclined to go a little further and suggest that a certain proportion of health visitors should be medical women. He had recently been able to adopt such a plan in Croydon and had every confidence in the result. Mothers' meetings should be used for giving health talks and the instruction thus given should be organised by the medical officer drawing up the syllabus for these talks. With regard to the function of the health visitor in the elementary school, he was not sure of the value of occasional talks by peripatetic teachers except perhaps as a temporary expedient. It is the hygienic "atmosphere" that is really essential, and this can only be secured by the ordinary teachers being made responsible for teaching the laws of health. In conclusion he would like to know the population of the Administrative County of Warwick and the number of health visitors it was found necessary to employ therein.

OUR PRESENT KNOWLEDGE OF THE ETIOLOGY OF MEDITERRANEAN FEVER,

With special reference to the Royal Navy.

By P. W. BASSETT-SMITH, D.T.M.&H.Camb.,

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ABSTRACT.

History.

IN 1901 it was definitely proved that the *Micrococcus melitensis* or causative organism was not nearly such a delicate body as was generally believed; having great vitality in water, dust, etc., in the presence of light, cold, and drying, and that it was probably excreted in the urine.

It was also found that very minute doses of the living culture were able to set up the disease by artificial inoculation in man after an incubative period of from five to eight days.

In 1903 further observations were made, when Surgeons Shaw and Gilmour, R.N., at Malta, were able to demonstrate the presence of the micrococcus in the peripheral blood of five out of eight cases suffering from the fever; later in the same year it was found at Haslar in seven out of eighteen patients, up to the 142nd day of the disease. The persistent failure to isolate the organism from the blood in previous investigations was due probably to (1) too small quantities of blood being taken; (2) to the blood being transferred direct to agar surfaces in an undiluted state, when the bactericidal properties of the serum came into play, instead of adding the blood to large quantities of fluid media, as is now done.

We had, then, three important points to work on:—

1. The probable escape of the organism by the urine;
2. The resistant character of the organism outside the body;
3. The presence of the organism in small numbers in the peripheral blood, even up to quite late stages of the disease.

In 1904 the Royal Societies Commission took up the work under the

able management of Col. D. Bruce, C.B., F.R.S.; the working members at Malta being Staff-Surgeon Shaw, R.N., Major Horrocks and Capt. Kennedy, R.A.M.C., Dr. T. Zammit and Dr. R. W. Johnstone, of the Local Government Board.

The result of the first summer's work was to show the still greater vitality of the micrococcus as a saprophyte, that in dry dust it might be absorbed by monkeys, giving rise to the disease, also that it was frequently excreted in the urine of men suffering from the disease. Dr. Johnstone, in his epidemiological report, was most condemnatory of the general sanitation of the island.

In 1905 further investigations were made showing that the infection did not pass out by the breath, sweat, and skin, but by the urine and alimentary canal, and that infected clothing remained a source of danger for long periods. The most important observations were those demonstrating the wide-spread presence of infection in domestic animals and in apparently healthy natives; the cows and goats passing out the specific organisms abundantly in milk and urine, the natives while doing their usual occupations often infecting areas with urine containing the *Micrococcus melitensis.*

Some evidence was also brought forward showing the possible conveyance of infection by mosquitoes. Out of 896 mosquitoes examined, the micrococcus was found in four, these successful results demonstrating that the organism had not only lived, but that it had been able to multiply after removal from the body in the stomach of the mosquito.

Evidence was obtained of infection being conveyed to two monkeys by infected mosquitoes, and once in the case of a laboratory assistant; other modes of infection were, however, possible.

The Commission this summer is particularly investigating this question of insect-borne infection. The constant presence of the micrococcus in the blood of patients, even in small numbers, and the fact of growths of the organism having been obtained from the stomachs of several mosquitoes, make it most important to gain further information of this mode of propagation.

I have thus rather scantily run over the recent history of the work of experimental investigation still being carried on, let us now pass on to the epidemiological factors.

Geographical Distribution.

There can be no doubt that the chief endemic centre of this disease is Malta itself; but that many seaport towns in the basin of the Medi-

terranean, particularly in the eastern and southern portions, are endemic centres is highly probable.

Surgeon E. H. Ross, R.N., has certainly proved its presence at Port Said; Lamb and Pais have not only found it in man in the Punjab, but also in the goats there; Birt has shown that the disease is endemic in the Orange River Colony; and Staff-surgeon Bishop, who has suffered severely from the disease himself, was convinced of its presence in Hong Kong and Shanghai, not only as sporadic cases, but as endemically present.

We have, therefore, conclusive proof of the existence of the disease apart from the Mediterranean, and I would here strongly urge the disuse of a name which is misleading and wrong, for that brought forward by Hughes, viz., "undulant fever," a name which more readily describes the character of the fever than any geographical term.

The great prevalence in Malta is, as pointed out by Dr. Johnstone, mainly due to the extreme overcrowding of the island, and the porosity of the soil, everywhere heavily polluted with sewage of a population having dirty habits, and by great numbers of infected animals excreting the specific organism in their urine and fæces. The widespread prevalence of the disease through the island is also evident, it not being, as was formerly thought, restricted to the coast towns and villages.

From a consecutive series of cases I found the average duration of acute and sub-acute symptoms was four months; if we multiply the cases of the year by this number we see what an enormous loss of valuable service and what a great expense to the country this disease causes, which appears to be rather increasing than diminishing.

Seasonal Incidence.

In Malta, from a large number of computations, it is certain that, though present all the year round, the maximum incidence of cases occurs in the hot dry months of June, July, August, and September, the curve being very closely parallel with that of the temperature, and conversely to the rainfall. In certain years, however, this does not hold good, cases being very frequent in the winter months, pointing to some other cause of the prevalence of the fever than the temperature and dryness.

In the Navy the curve of incidence for the last five years was irregular owing to the movements of the fleet, but taking the shore establishments, it conforms with that of the general population.

The returns of the R.A.M.C. showed for 1904 among the men employed on nursing duties alone, a ratio of 300 per 1,000, ten times greater than that of the Army as a whole.

For the year 1905, Kennedy, in the R.A.M.C. Journal for April, gives an incidence of 23 out of 85 R.A.M.C. and attached men, or 270 per 1,000, the general ratio being 82 per 1,000.

The importance of this high incidence in those employed nursing the sick is very great as an etiological factor, and becomes still more so when we find that of all those who suffered, the greatest danger appeared to be among the men actually engaged in the Acute Mediterranean Fever Ward at Valetta hospital, where the incidence was 100 per cent. for the nurses, and 33 per cent. for those on general duty.

Relation of Cases to Ships and Buildings.

From an analysis of the cases it appears that almost every ship on the station contributed cases, and that those ships which spent most time at Malta had the greatest relative number, the men in stationary ships suffering practically the same as those living on shore. Here, of course, the frequency of leave would make it impossible to trace the source of the infection.

Possible Methods of Infection.

1. Through dust contaminated with infected sewage.
2. Through infected food.
3. Through direct inoculation from contact with patients or their excreta.
4. By means of blood-sucking insects, chiefly mosquitoes.

1. Experimental work in the laboratory has proved that the micrococcus can live for long periods in a dry state in dust and soil, that monkeys can be infected by this dust when blown down their throats, etc., therefore it is possible that the disease in man might be conveyed by inhalation or swallowing naturally infected dust. Favouring this view is the fact that numbers of men on board ship, who have not landed at Malta at all, have contracted this disease, but at the same time one must bear in mind that to infect monkeys enormous doses have had to be used. and that in man other possible means, as 2 and 4, may have been the cause. At present, this view has few supporters.

2. *Through infected food.*—One of the most important discoveries of the present inquiry has been to show that 50 per cent. of goats in Malta are carriers of infection, that 10 per cent. pass the *Micrococcus melitensis* out in their milk, and that up till lately this infected milk has been freely used in the endemic districts. That milk can and does convey the disease when used unsterilised is now a fact beyond dispute. One of the most

important examples of direct evidence proving that infected milk does produce the fever in those who drink it, is found in the outbreak of the disease in the s.s. "Joshua Nicholson." This ship carried a number of goats from Malta; the crew made use of the milk from these animals and many of them contracted the disease, those joining after the goats were landed being free.

That milk is largely responsible for the fever in the Army is a view not accepted by Col. Davies, who went fully into the subject, for he says in his report: "It would not be justifiable to affirm that the circumstances of milk supply of the troops, considered in relation to the fever prevalence, in any way invalidate the theory of milk transmission, but I do not find anything in the circumstances as they existed in 1905 to lead me to suppose that milk can have any important part, or indeed any part at all, in disseminating the specific poison during the epidemic *amongst the troops.*"

I think the same holds good with the Navy, for very little fresh milk is consumed either on board or on shore by the British bluejacket. From 97 men who had been invalided for the disease from Malta and were under treatment at Haslar, I made a careful inquiry as to whether before the onset of the fever they ever drank fresh milk either on board or on shore, with the result that 30 stated positively that they had not done so, therefore some other cause of infection must be sought to explain their infection.

The high incidence in the hospitals would appear at first to be easily explained by the patients receiving in their dietary the infected milk, for Shaw was able to show that out of the 90 goats supplying milk to the hospital, 30 were found to be infected, and the micrococcus was recovered from the milk of 9, or 10 per cent. That this is not, however, the cause would seem likely, as since the milk has been subject to careful sterilisation the incidence of cases in the hospital has *not* appreciably diminished.

3. *Through direct inoculation by contact with patients or their excreta.*—The high incidence in the hospital staff, and particularly among the nurses in direct attendance on acute Mediterranean fever patients, points strongly to this means of infection. We know that the urine of those suffering from both acute and chronic stages of the fever and also, from Shaw's experiments with dockyard employees, that of some apparently healthy men, contains frequently the specific organism. It has been proved that clothing, etc., infected with the organism retains for a considerable time its dangerous qualities, and that in man a very minute dose directly inoculated, accidentally or otherwise, is able to produce the disease. It is

therefore possible that any nurse having slight abrasions on the hands, etc., might so become infected, and in the management of cases the fullest methods of disinfection should always be employed, as well as definite instructions given to the nurses themselves.

That this method is common or likely to cause the high incidence in hospitals at Malta I think is not likely, for why then should the nursse at Malta suffer so severely and those at the home hospitals *not at all.*

This direct inoculation cannot apply to sporadic cases on board ship, and it is these cases which most require explanation.

4. *By means of blood-sucking insects.*—In relation to this we have some very important facts to deal with:

a. In the peripheral blood of patients suffering from the fever the the *Micrococcus melitensis* is present, though in small numbers.

b. The great prevalence of mosquitoes throughout the island and in other Mediterranean ports, which are acknowledged by both sick and healthy to be most troublesome.

c. The prevalence of the fever all over the island and on board ships, particularly those that are in the dockyard.

d. The great prevalence of the fever in hospital buildings, both at Malta and Port Said, and in certain low-lying enclosed forts.

e. The successful culture of the *Micrococcus melitensis* from the stomach of mosquitoes, by Horrocks and Kennedy, one being taken in the acute Mediterranean fever ward of Valetta hospital.

f. The experimental inoculation of monkeys by infected mosquitoes by Zammit and Kennedy, and also the case of a laboratory assistant who was bitten by an infected mosquito, and who developed the fever eleven days after.

It would seem that here we have a factor present in the hospitals abroad and not at home, able to explain the discrepancy of the incidence in the nursing staffs at the two places. It offers a means of transmission which can explain the incidence of attacks on board ships, the comparatively few cases found in each ship being due to the rarity with which a mosquito would become infected, owing to the paucity numerically of the specific organism in the blood and the small quantity of blood each is able to imbibe.

Ross, in his reports of Port Said hospitals points out that the time incidence of cases is easily explained on the mosquito transference theory.

From the evidence at present obtained, it would appear that Mediterranean fever has several methods by which the infection is conveyed to

man, each acting more or less powerfully on different groups of the population in the endemic areas, the most certain channels being by

1. Ingestion of infected unsterilised milk.
2. Direct inoculation by infected mosquitoes.
3. Direct inoculation through the skin, etc., by infected excreta and articles contaminated with these.

LIEUT.-COL. A. M. DAVIES (Royal Army Medical College, London) said that the chief difficulty in determining the mode or modes of spread of this disease lay in the uncertainty that at present exists as to the length of the incubation period; it is therefore very difficult to trace out the causation in any individual case, the time when, and therefore very often the place where, infection was contracted being uncertain. Some local condition, some direct or indirect transmission depending on local or personal conditions, appears to be necessary to explain the numerous instances of special local incidence that have been noted. The mosquito transmission theory would satisfy these requirements: but it cannot be said to be as yet proved. The milk transmission theory is probably valid as regards the native population of Malta; and as regards the children of British troops, during 1905 the incidence on those who partook of raw milk was about three times as great as that on the children who only took boiled or condensed milk. As regards the troops the milk theory does not explain the facts: so far, all milk (practically) has been boiled for the past year (1905), but a very large number of cases had occurred notwithstanding. Moreover, in hospitals, the milk has been pasteurised for two years or more, but many cases have contracted the infection while staying in hospital.

POST-SCARLATINAL DIPHTHERIA AND ITS PREVENTION.

By JAMES FLETCHER, M.D., D.P.H.,
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THIS subject is of extreme importance to those who have to administer Fever Hospitals, and though for many years it has been a positive scourge in some institutions, yet, theoretically, at any rate, with the aid of bacteriology it is a preventable disease.

I would in the first place define Post-scarlatinal Diphtheria as the growth of the Diphtheria bacillus on one or more mucous membranes, giving rise to naked-eye signs and constitutional symptoms in patients who are convalescent from an attack of Scarlet fever.

The subject will be considered under the following headings: (1) Ætiology, (2) Clinical Experience, (3) Prevention.

1. The following possible factors in the causation of post-scarlatinal diphtheria deserve notice :—

(i.) *Sanitary defects and unhealthy surroundings.*—The idea that defective drains and foul odours may give rise to an attack of Diphtheria has long been cherished by the public, and to some extent even by members of the medical profession, but when one sees in an epidemic of Diphtheria that the newer and more sanitary parts of a city provide more cases than the slums, one fails to recognise any direct causal relationship. Further, Post-scarlatinal Diphtheria occurs and will occur in wards which are well ventilated and thoroughly sanitary, unless the cause is looked for in the patients themselves. In other words the disease is a personal one and personally propagated, and at the utmost the above two factors can act merely as predisposing causes in lowering the general condition of the patients.

(ii.) *Overcrowding.*—It follows from the preceding paragraph that overcrowding in wards may be an indirect cause, for more or less vitiation of the atmosphere must occur, thus tending to lower the patients' vitality,

and as the disease is personally propagated the more patients the more chances are there of the disease being introduced, and of it spreading.

(iii.) *Introduction into wards, through error in diagnosis, of cases of Diphtheria.*—The admission of such cases is naturally a most potent factor, but with the aid of bacteriology and temporary isolation till the diagnosis is settled the risk should be very small. Fortunately, in cases removed early in the disease, the symptoms of Scarlet fever are fairly well marked, but in all doubtful cases the presence or absence of the Diphtheria bacillus must be ascertained by bacteriological methods. I consider also that we have in Bristol to thank the Public Health Department for encouraging the taking of swabs for examination from cases of sore-throat, and thus preventing the admission of mild cases of Diphtheria.

(iv.) *Introduction into wards by patients actually suffering from the two diseases on admission.*—The percentage of cases in which patients are actually suffering from Scarlet fever and clinical Diphtheria on admission has been in my experience very low, although it is stated that 1,046 cases of the combined diseases were admitted into the London Fever Hospitals in the four years 1896-1899, giving a percentage of about two.

During the five years 1901-1905 only four cases have come to my notice out of 2,208 admissions.

However, the admission of such cases should lead to no trouble, as the naked-eye signs lead to instant isolation and confirmation by bacteriological examination.

(v.) *Introduction into wards by patients harbouring the Diphtheria bacillus in nose, or throat, or both, but with no clinical symptoms of the disease.*—Scarlet fever patients are extremely liable to be harbouring the Diphtheria bacillus when outbreaks of the two diseases are running concurrently, as has been the case in Bristol, and the danger is at its maximum, not when the Diphtheria cases are well-marked and the fatality rate high, but when the epidemic is declining, and there is a high percentage of "carriers" of the disease found.

An excellent opportunity of studying the behaviour of the disease has been afforded in Bristol during the last four years, and the information which I shall bring forward is, I think, of the first importance. Diphtheria has for so long a time been looked upon as a throat disease with well-marked signs and symptoms, and often a fatal termination, that an ambulant variety of the disease has not, at any rate until recent times, been recognised.

Different observers have found these epiphytic bacilli at times patho-

genic, at others apparently innocuous, but I am firmly convinced that the latter evidence is of no value, for an attack of Scarlet fever seems to so prepare, especially the pharyngeal and laryngeal mucous membranes, that there is every likelihood of the bacilli assuming virulence later when planted on a suitable soil.

In other words, all Scarlet fever patients who have bacilli morphologically corresponding to the Diphtheria bacillus in their throat or nose on admission should be isolated, and I believe this to be the keynote in the prevention of Post-scarlatinal Diphtheria.

(vi.) *Nursing the two diseases on the same site.*—With anything like ordinary isolation precautions it is hard to see what danger there can be in this. Further, Post-scarlatinal Diphtheria is just as common in Hospitals which nurse only Scarlet fever patients as in those which receive both diseases; another point of interest is that it is common in Hospitals receiving only convalescent Scarlet fever patients.

(vii.) *Infection by members of the Staff.*—This is a possible cause in some cases, through the transference of nurses from Diphtheria to Scarlet fever wards, or through nurses suffering from an unreported or unrecognised mild attack. I have met with one instance in which a nurse suffering from mild pharyngeal Diphtheria infected sixteen Scarlet fever convalescents, six of whom died.

(viii.) *Sex and age.*—Sex apparently has little influence, but most of the cases occur in children at the school-going ages.

Clinical Experience.

One cannot help being struck by the frequency with which the nasal cavity has been found harbouring the Diphtheria bacillus, at any rate in Bristol, and as this has a distinct bearing on what follows, the following statistics are of interest: out of 1,036 cases of Diphtheria admitted to the Ham Green Fever Hospital during the years 1901–1905, 246 had the disease in the nose only, and 103 others in the nose as well as throat. As all the nasal and the majority of the nose and throat cases were simply "carriers" with no constitutional symptoms, one would naturally expect that an appreciable proportion of the Scarlet fever admissions would also show the presence of the bacillus in the nose or throat.

In order to gain some information on this subject, nose and throat swabs were taken from Scarlet fever admissions at one of the City Hospitals with the following results: of 297 patients examined, 17 had the Diphtheria bacillus in the nose, 3 in nose and throat, and 4 in the throat.

Now, scarlatinal convalescents are extremely liable to develop rhinorrhœa during the fourth, fifth or sixth week of their illness, and as this is also the period during which Post-scarlatinal Diphtheria appears, and seeing that the nose so frequently acts as a nidus, I thought there might be some causal relationship between the two.

Some excellent evidence in support of this was furnished in an outbreak of Diphtheria among scarlatinal convalescents in the Ham Green Hospital in 1902, which I feel sure was due to the admission of convalescent scarlatinal patients suffering from primary nasal Diphtheria.

There had been no case of even suspected nasal or faucial Diphtheria in certain wards for a year, yet following the introduction of the above cases of primary nasal Diphtheria, in three out of the four pavilions faucial cases occurred, and in each of two pavilions a nasal case occurred. Such facts as these, I think, speak for themselves. How many faucial cases would have occurred had not antitoxin been freely used as a prophylactic of course is doubtful, but it is a clinical fact worth recording that no patient who had had a prophylactic dose contracted either faucial or nasal Diphtheria.

On finding this condition of things among the transferred patients, I thought it would be interesting to see the condition of the 19 patients left behind at the other City Hospital. On examination the Diphtheria bacillus was found in one case in the throat, in three cases in the nose, and in two cases in the ear. The smaller proportion of affected cases may be due to the fact that only convalescent cases were transferred to this Hospital. I consulted the medical attendant as to the supposed cause of the infection and he attributed it to a patient suffering from Scarlet fever in whose nose the Diphtheria bacillus was found.

The patients transferred to this hospital occupied two adjacent pavilions at the first hospital, between which there was the most free communication, hence the conditions were all in favour of the spread of such a disease.

It is to me a most remarkable thing that so many patients should be harbouring virulent material without showing manifest symptoms, yet such was the case.

Two cases of Post-scarlatinal Diphtheria occurred in 1903, none in 1904, and two in 1905, and on inquiry into the cause, in every instance patients suffering from this mild variety of nasal diphtheria were found in the wards; the number discovered suffering from nasal Diphtheria being 5 in 1903, 14 in 1904, and 21 in 1905.

Year.	Scarlet fever discharges.	Primary nasal diphtheria cases.	Post-scarlatinal diphtheria cases.	Rate per cent.
1902	540	12	6	1·1
1903	377	5	2	·5
1904	326	14	0	—
1905	426	21	2	·4
Totals ...	1,669	52	10	·5

The introduction of Diphtheria through the agency of the throat is not nearly so much to be feared, for a clinical or suspicious attack on admission is at once detected, and any case of sore throat during convalescence is always complained of and can be investigated. Further, the throat in Scarlet fever patients always comes in for routine antiseptic treatment and so is not so liable to be a source of infection.

It is a different question with the nose, for patients can be admitted harbouring the bacillus in a quiescent condition, and displaying no symptoms, until the convalescent scarlatinal rhinorrhœa gives it as it were a fresh lease of life; then such cases, unless detected and the patients isolated, spread the disease in the many ways which convalescence renders possible.

No trouble has arisen in this Hospital from the admission of combined clinical Diphtheria and Scarlet fever cases, or mild Diphtheria cases, as their true nature has been revealed by bacteriology.

Most Scarlet fever patients are in bed for the first three weeks of their illness, and this amount of isolation is apparently sufficient to prevent transference of infective material: it is only when children come into intimate contact with each other after that period that an ambulant disease like primary nasal diphtheria is able to produce its maximum effect.

There have thus been in Bristol during the past four years all the conditions predisposing to the admission to Scarlet fever wards of mild Diphtheria, combined Diphtheria and Scarlet fever, and Scarlet fever cases harbouring the Diphtheria bacillus, and the consequent production of cases of Post-scarlatinal Diphtheria, yet the rate has been kept very low by the aid of bacteriology.

The bacteriological investigation of every case of Scarlet fever admitted is no doubt a laborious proceeding, but I am convinced that it would lead to the disappearance of this serious complication: however,

if all doubtful cases on admission, and all cases of rhinorrhœa during convalescence are thoroughly examined, little need be feared.

It may be well to mention that all cases of otorrhœa should be examined, as the discharge frequently teems with the Diphtheria bacillus; but as this condition is usually secondary to a previously diagnosed nose or throat affection little harm can ensue.

Fortunately if a case of Post-scarlatinal Diphtheria does occur in a ward we have Diphtheria antitoxin to fall back upon, and there can be no doubt from experience gained in this Hospital of its prophylactic value.

PREVENTION.

The following conclusions appear to be warranted in the matter of prevention:—

1. The encouragement through the Public Health Authorities of the taking of swabs by general practitioners from all cases of sore throat doubtful in nature, and from the nose or throat of any Scarlet fever case which suggests the presence of a double infection, and their examination bacteriologically before admission.

2. The bacteriological examination of nose and throat of all Scarlet fever admissions; but if not workable, at least the examination of all doubtful cases, and a rigid examination of all cases of rhinorrhœa, otorrhœa, or sore throat occurring during convalescence.

3. The nursing apart of all patients who are found harbouring the Diphtheria bacillus in nose, throat, or ear.

4. The prevention of any mingling of patients convalescent from the two diseases.

5. The bacteriological examination of nurses and maids who are transferred from Diphtheria to Scarlet fever wards, and of any case of rhinitis or sore throat occurring among the nursing staff.

6. When any case of Post-scarlatinal Diphtheria does occur in a ward, a prophylactic dose of antitoxin of at least 500 units should be given each patient, detention in bed should be imposed on all, and the infecting case sought for.

[*For Discussion on this Paper see page 394.*]

ON SOME POINTS OF INTEREST IN THE TREATMENT OF OUTBREAKS OF DIPHTHERIA.

By F. T. BOND, M.D.

I THINK it will be admitted by those who have had much experience of diphtheria, especially of late years, that it is essentially a school disease. The idea that it is a drain disease may be considered to be exploded. The germ of diphtheria is so clearly air-borne, and there is so complete an absence of any evidence that it can exist in liquids, such as sewage, that it is unnecessary to invoke any other reasons in opposition to this now obsolete idea, which is characteristic of a stage of sanitary development when bad drainage did duty as an explanation of the source of infectious disease generally, and when the most effective remedy the sanitarian could suggest was, to parody the well-known saying of Danton, "des égouts, et encore des égouts, et toujours des égouts."

The incidence of any individual attack of diphtheria undoubtedly involves the existence of three conditions: (1), the invasion by a germ, of a specific type, (2), a susceptible mucous surface, on which it can proliferate, and (3), a susceptible host, on which the toxin produced by the proliferation of the germ can produce its characteristic pathological effects. What the precise conditions are which favour the maintenance of the existence of the diphtheritic germ, whether in the form of organism or resting spore outside the human body, we do not know, but there can be little doubt that when once started on its wandering career it may remain suspended for some time in the air until it happens to find a suitable resting-place on which its further development can take place. The most appropriate nidus on which it can alight appears to be that congested condition of the naso-pharyngeal mucous membrane which is so common in early childhood and exhibits itself so perceptibly in chronic enlargement of the tonsils. What are the causes of this pathological condition it is not necessary here to discuss. It is sufficient to say that it is extremely common, that it is distinctly hereditary, and therefore, a family character-

istic, and, that if it is not actually the result of living in a chronically vitiated atmosphere, it is at least materially promoted by such a condition.

Now it is a matter of common knowledge that whilst sporadic diphtheria may occur in the healthiest localities, in regard especially to elevation above the sea level, exposure to sun and wind and absence of any obvious insanitary conditions, it has little or no tendency to spread and become epidemic unless the infection finds its way into a school. And the way in which it does so is either by the child who is first attacked being allowed to return to school before its nose and throat are free from infection, or from some other child in the same household, who has not been the subject of an overt attack of the disease, conveying the infection in an unrecognised way.

The infection, once introduced into the atmosphere of the school, will be more or less readily diffused amongst the susceptible children who inhale it, and will thus become epidemic, in proportion to the number of susceptible children present, to the special virulence of the type of the infection, and mainly to the overcrowded and ill-ventilated condition of the school itself. A thoroughly well-ventilated and not over-crowded school is practically immune to diphtheria, which chiefly hangs about old non-provided schools that are much below the standard of what a healthy school should be, in regard especially to these two points.

But, for the present at any rate, we have to take schools as we find them, and as it is not likely, in view of the large cost involved in replacing these defective schools by better ones, that this will be done for some years to come, the question which suggests itself is, what steps can be taken to prevent these schools from acting as centres of infection when diphtheria happens to have got a foot-hold in connection with them? Obviously the first thing to do is to ascertain how far that foot-hold extends. This can only be done by a bacteriological examination of the noses and throats of a sufficient number of the children to afford a fair sample of the whole.

And here we find ourselves in face of a practical difficulty. Who is to undertake this work? It is clearly no part of the duty of the sanitary authority, as such, to do so. It is a special work which is rendered necessary by the defective conditions under which the education of the children is carried on, and the duty of providing for it is incumbent on the education authority, which must be held responsible for the maintenance of the health of the school in this as well as in other respects. Where the education authority and sanitary authority are the same body, as in

county boroughs, this difficulty does not, in theory, at any rate, exist; but in rural and small urban districts, in which this is not the case, it is a serious one, which can only be met by the education authority making provision for the supervision of the health of the children.

But, assuming that the result of sampling a sufficient number of children in a suspected school goes to show that a notable proportion of them exhibit evidence of the presence of diphtheritic infection, in a bacteriological though not in a clinically active form, what course should the medical officer of health take? This was a problem which presented itself to me recently, under circumstances which it may be well to relate.

In two adjacent parishes in one of the rural districts for which I act, cases of diphtheria had been notified in a way which led me to suspect that the school in each parish was acting as a centre of infection. In view of this probability, I put myself in communication with the two local medical men who practise in these parishes, both of whom cordially undertook, with the assistance of a trained nurse and of the schoolmaster, which was, fortunately, available in each case, the swabbing of the noses and throats of the whole of the children of both schools, some 370 in number. The swabs thus obtained were then sent to Professor Stanley Kent, of University College, Bristol, who also very cordially gave his assistance in the matter, with the following result: in 8 cases the Klebs-Löffler bacillus was found in free growth, in 1 case in one school and in 7 in the other; in 107 cases the bacillus was found in scanty growth, in approximately equal proportions in both schools; and in 107 cases, but more in one school than in the other, organisms of the Hoffmann or other suspicious forms were found, whilst in 83 cases the results were negative. It may be interesting to note that whilst in 16 swabs positive evidence was obtained from the throat only, 149 swabs from the nose exhibited it, and 230 from both nose and throat, thus confirming the now well-recognised predominance of the nose as the seat of the early infection, at any rate, of the disease.

The question now presented itself, what course should be taken in regard to these schools? I ought, perhaps, to mention that this revelation was obtained in the month of November, as a sequel to a slow but steady increase of cases of a generally mild type, which had been going in both parishes since the end of the summer. There was, therefore, little prospect of improvement, under conditions which would be increasingly favourable to the spread of infection amongst the children. Under ordinary circumstances I should have felt bound to advise the immediate

closure of both schools, with the prospect of keeping them closed for at least eight weeks, and of even then only re-opening them on speculation, unless the laborious process of sampling a considerable proportion of the children were previously undertaken. The prospect of this serious dislocation of the educational work of these schools, which might possibly have to be prolonged for a longer period than even eight weeks, was not an agreeable one, and, in discussing it with one of the gentlemen to whom I have referred (Dr. Macwatters, of Almondsbury) we decided, with the co-operation of the other medical practitioner (Dr. Macwatters' partner, Dr. Irwin, of Olveston), to try the following experiment: to keep the schools (both day and Sunday) open, and to spray the throats and noses of all the children, twice daily, with a ten per cent. solution of carbolic acid. This was done by the assistance of the nurses and school staff, as before, with the satisfactory result that up to the present time, now more than six months, only five cases of diphtheria have been notified in the two parishes, all of them in February and March, and three of them in one house.

That this almost complete cessation of the dropping fire of notifications, which had been steadily increasing in the two parishes before the spraying treatment was adopted, was largely if not wholly due to it, is at the least highly probable; though it is, of course, impossible to say that it may not have been a coincidence attributable to a spontaneous establishment of immunity amongst the children. That such an establishment of immunity does take place after a time is unquestionable. If it did not, there are some schools from which diphtheria would never be absent.

But, whatever the conclusion to which we may be disposed to come on this point, the experiment may be regarded as an interesting one, and it had two distinct compensations for the somewhat heavy cost of notifications; it supplied precise evidence, so far as the only test available can give it, of the prevalence of serious throat mischief amongst the children attending both schools at a time when clinical diphtheria appeared to be increasing, and it provided a justification for keeping the schools open and thereby preventing the complete arrest of the educational machinery for a period of at least two months, in the face of a strong public feeling that they ought to be closed. For the public have got into the way of looking on the closure of schools as the proper and only remedy for an outbreak of infectious disease however small; and it often requires some decision on the part of a medical officer of health to decline to close a school when he is asked to do so by managers who are afraid of losing the grant, or when

the attendance falls off in consequence of an unnecessary panic amongst parents.

But there are two other points of view from which this experiment provides food for thought. The first is in regard to the question, what is notifiable diphtheria? So long as we had only to deal with diphtheria in its clinical aspects, it was generally assumed that the presence of an exudation, if not of a distinct membrane, was sufficient to justify the notification of the disease. But we now know that we may have an exudation without evidence of the presence of the characteristic bacillus; whilst, on the other hand, we may certainly have proof of the presence of the bacillus without there being any perceptible exudation at the time it is discovered.

The problem is further complicated by the differentiation which bacteriologists have established between (*a*) cases in which the Klebs-Löffler bacillus is present in free growth, (*b*) those in which it is present only in scanty growth, and (*c*) cases in which it is not present at all, though other highly suspicious organisms, of the so-called Hoffman type, are. Does the presence of these suspicious organisms itself justify the notification of the case as one of diphtheria? And, if so, what is the Medical Officer of Health to say to allay the anxiety of his Sanitary Authority and the subsequent panic of the public, when the reporters, always on the look out, like Dickens' fat boy, for something that will "make your flesh creep," inform everyone that there is an epidemic of diphtheria at Little Pedlington, more than one hundred cases having been notified, and when the neighbouring localities, always so conscious of one another's shortcomings, insinuate that Little Pedlington is little better than a pest-hole, though it may really be as healthy as most other places. An answer to this question is the more important because in such an experiment as that just described the cost of notification mainly arises from the predominance of the "C" group of cases.

The other aspect of the matter is an equally important one, both to the medical profession and to the public, involving, in another way, considerations of finance. Such work as sampling the throats and noses of children who are not actually ill, even if it were a prescribed duty on the part of Medical Officers of Health, would be an impracticable one in such districts as mine on anything like the scale on which it was done in this inquiry. But, if it is to be done, as it was done here, by local persons, and preferably by medical men, they are entitled to claim remuneration for it. That remuneration may be provided for either by the fees to which they are entitled for notifying the cases which they are justified in returning as diphtheria, in which case the cost comes out

of the pocket of the Sanitary Authority, who are not reimbursed in any way for it, or by an arranged payment for it by the Education Authority.

Then again, if it should appear as the result of larger experience, that local medication of the nose and throat is distinctly valuable as a means of prophylaxis in the early stages of diphtheritic infection, whether by the direct destruction of the infecting organisms or by stimulating the invaded mucous membrane to throw off the invading hosts by a recuperative effort on its own part, how is this work to be provided for? Even if swabbing children's noses and throats could be shewn to be part of the work which medical officers of health must undertake in addition to their already heavy duties, without proper assistance for so doing, it could scarcely be claimed that they are also bound to undertake the spraying of these organs as a form of antiseptic treatment. In a local outbreak connected with another school in which a local practitioner was induced to adopt this line of treatment with, it must be admitted, not such successful results as in those described, I succeeded in obtaining for him the modest remuneration of two shillings for each case treated under his supervision, half of which was paid by the County Education Authority, who, I presume, have satisfied themselves as to their legal power to spend their funds in this way, and the other moiety by the District Council, who will present it for the consideration of the auditor under the head of "disinfection of children's throats."

Then there is the further question, which is germane to this subject, of the provision by the Sanitary Authority of antitoxin, not for prophylactic purposes but for treatment. Where the Authority has provided an isolation hospital there is no difficulty about its also providing antitoxin for the treatment of cases of diphtheria in the hospital, but it can only legally do so for cases outside the hospital by a sort of pious fiction, including the cost in the working expenses of the hospital. A Rural District Council can, as a Board of Guardians, provide antitoxin for the treatment of paupers at their own homes, but it is not always easy to induce them to do so. And even if they do provide it, this does not cover the cases of persons who are too poor to allow of their being charged for it by their medical attendant, though they are not actually paupers. An Urban Council that has no hospital, cannot legally provide antitoxin at all.

Altogether, it will thus be seen that the treatment of diphtheria, whether in a sporadic or an epidemic form, in the most effective and rational way, bristles with difficulties for the Medical Officer of Health, of which no one had any anticipation when the consolidation of the Public Health Acts took place thirty years ago, but which now, together with

other perplexing problems outside the subject of diphtheria, urgently call for an extension and a further codification of public health law.

[*This Discussion applies also to the paper by* DR. JAMES FLETCHER, *page 382.*]

SIR CHARLES CAMERON (Dublin) said that the causation of diphtheria and enteric fever could not closely resemble each other, though there was a popular idea that both were associated with defective sewerage. In Dublin, enteric fever was steadily declining whilst diphtheria was increasing. There was no disease more indicative of defective drainage than sore throat, but he did not think that sore throat was true diphtheria. In hundreds of cases of sore throat he found the cause unquestionably due to emanations from drains. He had noticed that as regards diphtheria it seldom happened that more than one case at a time occurred in the same house, except during an epidemic, whilst the contrary was the case as regards typhoid fever, scarlet fever, measles, and smallpox.

ALDERMAN THOMAS WINDLEY (Leicester) said the discussion had been an interesting one from a medical point of view, but he approached the subject from the view of Chairmen of Sanitary Committees. They had heard a good deal as to the treatment of diphtheria after the disease appeared; what he wished to know was what was the cause of the disease. It was said in the papers before them that diphtheria was not a drain-caused disease, but nothing was said as to what was the actual cause. In Leicester twenty years ago there was scarcely a case of diphtheria reported; the disease was believed not to exist, and strange to say, notwithstanding the great sanitary measures which had been carried out since that date, a widespread epidemic occurred a few years ago; there were many hundreds of cases, and many deaths. The medical men in the town were unable to throw any light upon the cause of the disease. The medical officer of health was equally in the dark; he found cases in houses where no sanitary defects were discoverable. The disease appeared in a mysterious manner, it ran its course, and disappeared just as mysteriously. He would be glad if any one could throw light on the causation of the disease, as it was only when they got at the cause that preventive measures could be adopted.

MISS M. KEITH DOWDING (National Health Society) said that hot weather affected the keeping of food, therefore on a hot day the milk went bad and the baby had diarrhœa. When it was cool the milk did not go bad, and the baby did not suffer. With other food it was the same. Then as to drains or sewage causing diphtheria or scarlet fever, the plea that they (with enteric) must be therefore cognate did not follow. The general health suffers, and the lowered vitality is more susceptible to any specific diseases. Therefore, in a house with defective drainage several people might fall ill of different diseases.

DR. FRANCIS H. MAY (Aston Manor) said he was of opinion that post-scarlatinal diphtheria was an isolation hospital disease, due principally to the crowding of wards with its consequent evils; it was also due to the want of more frequent cleansing of the wards, and not permitting them to lie fallow for short periods in turn. The steam disinfection of bedding, etc., in the wards is too often omitted or not carried out often enough. More care might be paid to cups of milk standing about wards, and often drunk out of by several children. Post-scarlatinal diphtheria being almost absent in cases of scarlet fever treated at home pointed forcibly to it being a hospital disease.

MR. J. O. SYMES (Bristol) deprecated the placing of undue importance upon bacteriological examination. 50 per cent. of children in Bristol had short forms of diphtheria bacilli in nose or throat. Clinical and bacteriological examination must run together, inspection singling out the cases to be swabbed. Post-scarlatinal diphtheria was rare in private practice. This was a disease manufactured by overcrowded hospitals, or due to administrative defects.

DR. W. G. WILLOUGHBY (Eastbourne) thought too much stress was laid on bacteriological examination in diphtheria. He would use bacteriological examination as adjunct only to clinical examination and not clinical examination as adjunct to bacteriological examination. As regarded post-scarlatinal diphtheria he had found cases occurred only when overcrowding or some other untoward circumstance existed. In a straight-forward, well-managed hospital such cases ought to occur no more than in private practice.

DR. HERBERT JONES (Hereford) said he must protest against the statement that clinical examination should be relied upon to the exclusion of bacteriological (Dr. Symes did not say that). Dr. Symes said that in dealing with outbreaks of diphtheria, instead of examining every child in a school, only those should be examined who showed clinical signs. If there were clinical signs the assistance of the bacteriologist was not required. The clumsy way of dealing with an outbreak of diphtheria was to close the school because it was thought there were some centres of infection in the school. The scientific method was to hunt for the infective centres with the help of bacteriology.

DR. J. M. MARTIN (Gloucester C.C.) referred to the fact that the idea of drain diphtheria was still prevalent among the laity, and it must be recognised that the mucous membrane of the throat and nose is debilitated by being contaminated (*e.g.*, by drain air), and that then it is much more susceptible to the specific infection of diphtheria. The importance of detection of carrier cases in controlling the spread of diphtheria cannot be over estimated; and, as an instance, reference was made to the contrast between the result quoted in

Dr. Bond's paper, where in one district the disease had been stopped by systematic examination and treatment of school children, and in another district where the disease had spread over a period of eighteen months to two years owing to difficulties in making systematic bacteriological examination. Some of the difficulty was due to the want of proper relations between the education authority and the sanitary authorities.

Dr. W. A. Bond (Holborn) said that in order to prevent post-scarlatinal diphtheria, and the contraction of other infectious diseases at the hospital by patients who are admitted for scarlet fever or other infectious disease, it is desirable that patients should really be isolated, that is in separate rooms or cubicles instead of being simply *segregated* in *large* wards with many other patients who, in addition to the disease for which they have been admitted, may also be suffering from or incubating some other infectious disease. Last year he read in a French journal an excellent paper by the Medical Superintendent of the Pasteur Hospital, Paris, which gave an account of the cubicle system at that hospital, and details of about 2,800 patients consecutively admitted. The upper part of the cubicles is constructed of glass, so that no more nurses are required than in an ordinary ward containing the same number of beds. Although about one fourth of the patients were suffering from small-pox, and the cubicle system is not wholly adopted, the convalescent wards containing twelve beds each: out of about 2,800 patients there were only eight who contracted the infection of a second disease, that is less than *three* per thousand. He prepared details of the cases admitted to the Metropolitan Asylums Board Hospitals during the five years 1900—1904, and during those years of the scarlet fever patients admitted as many as *seventy-eight* per thousand contracted some other infectious disease: that is, more than twenty-six times as frequently as at the Pasteur Hospital, where various diseases are treated in the same pavilions. These facts show the very great advantage of strict *isolation* as opposed to *segregation* in wards. He might add that the average length of stay of patients in hospital would thus be reduced, and therefore the average cost of maintenance.

Dr. F. Vacher (Cheshire C.C.) wished to object to the proposal of isolating patients in wards divided up into *cubicles*. The better way of preventing patients being reinfected was to provide wards for acute cases quite separate from convalescent cases. Cubicles would increase the surface to be cleansed enormously, and interfere with the free circulation of fresh air, and add much to the difficulty of efficient nursing.

SCARLATINA AND CERTAIN OTHER DISEASES IN RELATION TO TEMPERATURE AND RAINFALL.

By R. SYDNEY MARSDEN, M.B., D.Sc., F.R.S.Edin.

Medical Officer of Health for Birkenhead.

IT has long been thought that in some way or other temperature and rainfall are associated with the spread of infectious disease, and it seemed desirable, therefore, that a series of observations should be taken which might help to throw light on this difficult but important point.

With this object I have tabulated the weekly variations of temperature and rainfall at Birkenhead for the past sixteen years (1890 to 1905), together with the number of cases of scarlatina, measles and typhoid fever notified to me as medical officer of health for the district.

In a paper read before the Royal Irish Academy this year (*Proceedings, Royal Irish Academy*, Vol. XXVI., No. 3), I have summarised the results, and do not therefore propose to go into all the details and statistics here, but simply to give the result of the observations as shortly as possible.

The complete tables on which these have been arrived at will be given in my annual report of the sanitary condition of Birkenhead for 1906.

In the following table I have put down the total amount of rainfall, the excess of temperature above the normal, and the number of cases of scarlatina, measles, typhoid fever and diphtheria occurring in the county borough of Birkenhead during the years 1890 to 1905, inclusive :—

No.	Year.	Total rainfall in inches.	Excess of temperature in ° F. over normal.	No. of wet days in year.	Number of cases notified during the year.			
					Scarlatina.	Measles.	Typhoid fever.	Diphtheria.
1	1890	26·820	− 0·3	199	247	1,620	182	35
2	1891	31·643	− 0·9	194	180	524	197	28
3	1892	33·032	− 1·5	211	218	1,542	150	25
4	1893	24·537	+ 1·9	181	421	540	221	77
5	1894	27·912	+ 0·8	202	379	1,818	194	133
6	1895	26·265	− 0·8	172	430	258	192	142
7	1896	26·633	+ 1·2	196	606	2,166	149	115
8	1897	28·580	+ 0·4	189	630	1,141	152	80
9	1898	25·719	+ 1·3	183	643	589	243	190
10	1899	27·807	+ 0·6	186	205	2,461	275	86
11	1900	32·054	+ 0·4	208	203	316	163	48
12	1901	25·192	− 0·1	190	266	2,179	207	75
13	1902	25·566	− 0·9	200	407	1,356	327	114
14	1903	34·418	− 0·1	224	658	420	79	101
15	1904	25·175	− 0·2	196	627	2,212	103	97
16	1905	24·011	− 0·1	192	874	979	62	138

Average rainfall for thirty-nine years = 28·613 inches.
Average temperature for thirty-nine years = 49·1 ° F.

The population of the borough had increased from 98,143 at Midsummer, 1890, to 115,979 at Midsummer, 1905. This must be allowed for to a certain extent in comparing the number of cases of infectious diseases notified.

The results of our inquiry, after a careful examination of the tables and curve-diagrams, are to show—

I. As regards Scarlatina.

That there is a rise in the number of cases after there has been deficient rainfall, and the number again falls after rain. Also, that after a series of dry years, the number of cases increases. This bears out Dr. Creswell's observation, and also that of Dr. Longstaff, "That the death rate from scarlatina increases in years of deficient rainfall;" as it will naturally follow that, with a large increase in the number of cases occuring, the number of deaths will be likely to rise also. Temperature has apparently little or no influence.

II. Measles.

In the case of measles, neither rainfall nor temperature has apparently anything to do with its spread.

III. Typhoid Fever.

Contrary to the well known views of Von Pettenkofer, the foregoing table shows the number of cases occurring in any year to be independent of the fact as to whether it is a dry or wet *year*; but the *weekly* tables

and diagram-curves show that there seems to be a *tendency* for the number of cases to fall after rain, and to rise in the dry weather. The number of cases dealt with in these tables is, however, too small to generalise upon. It is evident, therefore, that *atmospheric* temperatures have no effect on the spread of these diseases.

Scarlatina and diphtheria show a marked resemblance to each other in their method of spreading. Both increase after deficient rainfall, and recede after rain; and both spread more actively after a series of dry years. How far does the resemblance between them go?

If we consider how constantly these two diseases are associated together in the same individual; and, again, how it not infrequently happens that two persons in the same house, or even the same family, will be attacked simultaneously, one with scarlatina and the other with diphtheria, does it not suggest the possibility that these two diseases may be simply modifications of the same thing? Or, in other words, may they not be allotropic forms (to use a chemical term) of the same disease, as charcoal and the diamond are allotropic forms of carbon?

Dr. W. A. Bond (Holborn) said he would deal with Dr. Marsden's last point first, that scarlet fever and diphtheria may be allotropic forms of the same disease. He thought the truth of this was probably disproved by the fact that it also not infrequently happens that two persons in the same house, or even in the same family, will be attacked simultaneously, one with scarlet fever and the other with measles, or some other disease that may be prevalent at the same period. Dr. Marsden's argument would therefore lead to the conclusion that other diseases as well as scarlet fever and diphtheria are allotropic forms of the same disease. The prevalence of most diseases is known to vary according to season and the time of the year; for instance, scarlet fever and diphtheria increase in prevalence during the summer months, attaining a maximum about October or November, and then diminishing to a minimum about April or May. The amount of *infantile diarrhœa* depends very much upon the amount of rainfall and the excess of temperature above the normal; it being well known that during a wet and cool summer there is comparatively little infantile diarrhœa; and on the other hand, that during a very dry, hot summer there is an excessive amount. Dr. Longstaff also in his book, "Studies in Statistics," shows that many other diseases in addition to those named by Dr. Marsden vary in prevalence in relation to rainfall and temperature.

Alderman Windley (Leicester) said he had never connected the outbreaks of scarlet fever with the rainfall. The disease seemed to occur in cycles, and he

believed, by reference to statistics, they would find that epidemics had broken out every few years. In Leicester an epidemic began last year, and during the present year there had been a thousand cases notified, unaffected by rainfall. He agreed that with a wet and cool season the mortality from summer diarrhœa was greatly reduced. The reverse of this also held good.

Dr. C. V. McCormack (Bootle) said the fact that in wet, cold years scarlet fever and other infectious diseases were not so prevalent as in dry and hot ones may be explained by the probable fact that the common house-fly, which was most prevalent in hot weather, acted as the carrier of the infective microbe. Heavy rains would wash the streets, and so there would be fewer germs for the flies to carry about.

Dr. Francis Fremantle (Hertfordshire C.C.) said that with regard to the influence of rainfall on infant mortality, rainfall and fly prevalence appeared to be in inverse ratio. Flies might be largely responsible for epidemic diarrhœa, although this ratio was not absolute. The total annual rainfall in 1904 and 1905 in Hertfordshire was about the same, but the infant mortality, exceptionally high in 1904, returned to the average in 1905. The difference consisted in heavy falls of rain on certain days in May and June, 1905. These falls presumably killed off large numbers of fly-larvæ. An equal rainfall more evenly distributed in 1904 had a less destructive effect. The 2·65 inches, therefore, that fell on June 28th, 1906, are likely, materially and beneficently, to affect the figures for this year.

Dr. John E. Sandilands (Winchester) urged the importance of exact observations being made as to the relations between meteorological conditions and the prevalence of flies. Flies had been proved to be the carriers of infection in certain cholera and typhoid fever epidemics, but whilst the seasonal prevalence of these and other infectious diseases was well known, the seasonal prevalence of flies and its relation to temperature and rainfall had not been established and did not appear to have been made the subject of exact experiment.

Dr. W. H. Symons (Bath) said that rain acted as a cleansing and cooling agent: it was the great scavenger of our courts and slums, the enemy of flies. Scarlet fever and enteric fever were markedly alike in their seasonal incidence, and also diphtheria; but they need not think that therefore there was any common relationship between the infecting organisms. Wet weather was much healthier than dry weather, contrary to popular opinion.

THE INTERNATIONAL NOTIFICATION OF INFECTIOUS DISEASES.

By EDWARD WALFORD, M.D., D.P.H.,

Medical Officer of Health, City and Port Sanitary District of Cardiff.

(FELLOW.)

ALTHOUGH the subject of International Notification undoubtedly concerns inland towns, I shall confine myself chiefly to that part of it which is most closely related to port sanitary administration, and shall refer more particularly to smallpox, as one of the most important of the ordinary infectious diseases with which we have to deal.

All the ports in this country are more or less subject to the invasion of smallpox. The infection may be introduced by persons of our own nationality, or by aliens. Many of the extensive outbreaks of recent years in large towns owe their origin to invasions from abroad. The recent epidemics in London, Liverpool, and in some other places, were due, I believe, in the first instance to infection brought from foreign countries. All of us who are engaged in the public health service thoroughly appreciate the value of those weekly returns of the Local Government Board containing the records of the notification of infectious diseases in each sanitary district in the United Kingdom. They indicate at a glance the local incidence of disease, and in many cases the direction of an epidemic wave. Of the utmost value also are the prompt warnings from our colleagues of the possible danger to be apprehended from persons who have been exposed to infection, and who are proceeding to our district. But a shipload of such contacts may at any time come into any port without the slightest warning from abroad.

The danger of such an occurrence is sufficiently obvious, as, however vigilant the medical inspection at a port may be, it is made usually under somewhat unfavourable conditions, and a timely warning of what to expect would often prove an invaluable aid to diagnosis. Those of us who have had to examine Lascars or coloured men covered with coal dust and

dirt, and lying in a badly-lighted forecastle, will readily appreciate the difficulty of making a diagnosis in a case of smallpox in its early stage or in a modified form. For many years past I have felt that some system of international communication, more reliable than the official bill of health, would be a useful addition to our present methods.

The following recent event came to my knowledge through the courtesy of the medical officer of health of one of the largest ports in this country. A member of the crew of a steamer entering this port contracted smallpox on board, and on being paid off, went to his home in the North, then to the local infirmary, and was there found to be suffering from that disease. The infection in this case was derived from Spain. No notice was taken of the illness during the voyage, no mention was made of it in the log-book, and the captain disclaimed, of course, all knowledge of it. Thanks to the information received from the medical officer of health, I was on the look out for this vessel when she arrived in Cardiff; but how much more satisfactory would it have been if an intimation had been sent in the first instance from the port of departure in Spain.

At a conference held in London in 1904, relating to the spread of infectious diseases by vagrants, the following resolution was submitted: "This Conference is of opinion that the Port Sanitary Authorities should be authorised to take more stringent precautions to prevent the landing of persons arriving by vessels at the ports, who are suffering from smallpox, or who have been exposed to the infection of that disease, and for this purpose this Conference suggests that the regulations as to cholera, yellow fever, and plague, made by the Local Government Board on the 9th November, 1896, should be extended to smallpox." This resolution was not adopted in the form in which it was submitted. An amendment was moved and carried, omitting all mention of the Local Government Board regulations, which are not suitable for this purpose. Objection might be raised also to the wording of other parts of the resolution. For instance, smallpox patients must as a rule be landed, and also those who have been exposed to infection; the former for isolation and treatment, the latter for observation. The resolution is chiefly valuable as an expression of opinion of the conference that port sanitary authorities should have greater powers than at present. As a rule, however, little comes of these pious opinions, and pending the arrival of those greater powers, I would submit that an improvement in the methods of our International Intelligence Department might with advantage be attempted.

A vision of international notification seems to have floated before the eyes of the International Sanitary Congress held in Paris in 1903. From the report of the British delegates it would appear that at the first International Congress held in Vienna in 1874, there was a proposal to establish a central office under international management, and to collect and publish information on the course of epidemic diseases all the world over. This proposal was never carried out, but it was revived in a modified form by France at the conference of 1903. M. Barrère, who introduced the proposal, was careful to state that the bureau would be strictly international, that wherever located, the local government should exercise no controlling influence over it, that its main object would be to collect and distribute information about epidemics and the measures taken to deal with them.

The following resolutions (contained in the appendix to the report) were passed by the commission of ways and means of the Sanitary Conference of Paris, regarding an international health office:—

1. An international health office shall be established on the lines followed in the institution and conduct of the International Office of Weights and Measures. It shall have its seat in Paris.

2. The international office shall fulfil the function of collecting information as to the progress of infectious diseases. To this end it shall receive information given to it by the chief health authorities of the States that are parties to it.

3. The office shall periodically set out the results of these labours in official reports, which shall be communicated to the contracting governments. These reports must be made public.

4. The office shall be supported by contributions from the contracting governments.

5. The government, in whose country the international office is to be established, shall be charged with the submission, within three months of the signing of the proceedings of the conference, for the approval of the contracting States, of regulations for the institution and conduct of that office.

Article 181 of the Paris Convention refers to these resolutions as follows:—"The conference having taken note of the resolutions hereto appended, passed by its commission of ways and means, regarding the creation of an international health office in Paris, the French government shall, at such time as it may think fit, submit by diplomatic channels, proposals on this subject to the States represented at the conference."

The British delegates to the Paris Convention seem to have thrown a fair amount of cold water over this proposal. They report that, while from a theoretical standpoint this proposed institution had not a little to recommend it, there were important practical considerations which prevented them from giving it immediate and unreserved acceptance. They state that so far as concerns the obtaining of information on the course of epidemics, the machinery already possessed by His Majesty's Government for the purpose is as efficient as, if not more efficient than, any machinery that could be set up by an international bureau. It is doubtful, they think, if the reports from the bureau would be any more complete than those published by the Local Government Board, and that so far as the United Kingdom was concerned, the proposed bureau seemed to offer no advantage that she does not already possess.

The French delegates, on the other hand, seem to have attached much importance to the proposal. One does not quite know the real reason for the objection on the part of the British delegates.

There are, of course, difficulties in the way. Sanitary administration abroad is more a police affair than with us, and possibly the information obtained might have to filter through the hands of an army of officials before issuing from the bureau. In these days of rapid telegraphic and telephonic communication there need not surely be delay in the notification of a disease to a central bureau from any of the large towns and ports in Europe, from whence the information could be despatched as required.

No international arrangement could, of course, be come to with those countries in which antiquated systems of quarantine are carried out, and costly and useless restrictions are placed upon the movements of vessels. In such cases the notification of a case of smallpox in an English port might be the means of inflicting enormous loss upon the unfortunate owner of a vessel sailing from such port, quite out of all proportion to any possible advantage or gain to anyone.

A few words as to our present methods of obtaining information of infectious sickness on board vessels, and in this connection it must be remembered that, although on paper and in theory, cases of infectious disease on board ships and in houses are dealt with in the same way, in practice this is not altogether the case. Persons suffering from smallpox on land usually fall sooner or later into the hands of a medical practitioner. They find their way into the casual wards of workhouses, into infirmaries, into common lodging houses, and into places where medical attendance is at hand. On board ship, unless there is a doctor on board, such persons are more likely to escape detection. The Infectious Disease (Notification)

Act may be in force, but unless a doctor is called in, this Act is not of much service. The regulations under Section 125 of the Public Health Act, 1875, place the responsibility of notifying infectious disease upon the master or person in charge of the vessel, on entering port; but a conviction for neglecting to notify is seldom possible, as the master pleads ignorance and want of diagnostic skill. Evasions of this responsibility are extremely common, much more so than is usually supposed.

Customs officers boarding vessels from abroad notify to the sanitary authority any case of infectious disease which they may detect, but of course they are not very likely to detect anything of the kind unless their attention is called to it. A system of inter-communication between the various ports would undoubtedly be the means of reducing the number of these evasions; the master would feel that it was useless to practice deception when the authorities of the port of arrival might be already in possession of the facts. In many cases, of course, the master of the ship is not aware of the actual existence of a case of infectious disease at the time of arrival in port, but the information which we might expect from the port of departure would be an intimation of exposure to infection on the part of persons on board, and an indication that a careful medical inspection of such persons was called for.

It may be said that our system of medical inspection is not of much value if we cannot detect cases of infectious disease on board ships coming into our ports unless we have had previous warning arousing our suspicions. Many such cases are, of course, detected, but I would remind you that the medical inspection of persons arriving at our shores on vessels exists only in any degree of completeness at our large seaports, that in the majority of ports it is unknown, that it is not compulsory by law, except in reference to the introduction of cholera, yellow fever, or plague, and that even when it exists it must of necessity be carried out under unfavourable conditions, as to time, place, light, surroundings, etc.

Some notification, therefore, from the port of departure, in the case of vessels infected during any part of their voyage, would be of extreme value to the authorities of the port of arrival, and a useful supplement to the system of medical inspection, however efficient that might be.

In conclusion, I would suggest that international notification might be considered from two points of view. The primary object would be the concentration in a central international health office of all available information concerning epidemic diseases occurring in the countries entering into the convention, and the distribution of this information to the several countries concerned, very much on the lines of the arrange-

ment now so satisfactorily carried out by the Local Government Board in this country. I am inclined to think that information so distributed would have an official stamp upon it, and would be altogether more reliable than that which is derived from paragraphs in newspapers, a source of information recommended in a recent circular letter of the Local Government Board, relating to plague, in the following terms:—

> "It will be seen . . . . . that the Officers of Customs will look to the Medical Officer of Health to inform them from time to time of any particular ports or countries, the vessels arriving from which the Medical Officer may desire to visit, and in this connection the Board would observe that the earliest information which would usually be available to this end is that which would be obtained by a regular examination of the news telegraphed from abroad for the purposes of the Daily Press."

The responsibility, therefore, of determining which are infected ports rests upon the medical officer of health, who is expected to be a diligent reader of the daily papers. The Local Government Board, although always ready to assist and to give information and good advice, takes no responsibility in this matter. It is obvious that in the event of any obstruction to the officers carrying out the plague regulations, a newspaper paragraph would be an insecure basis upon which to found a prosecution. Information from an international bureau would be preferable.

The other aspect of international notification might assume more the shape of a prompt and fairly complete intelligence department between the countries concerned, having for its chief object the continued observation or medical inspection of persons who have been exposed to infection. At the present time medical officers of health are in the habit of forwarding to their colleagues lists of names and addresses, and the supposed destination of such persons, in order that they may be kept under observation until the expiration of the incubation period. Such a system might, without any great difficulty, be made international in its operation. Certainly the difficulty would not be insurmountable in the case of persons exposed to infection and forming members of the crew or passengers of a ship. It would in most cases be sufficient to indicate the name of the disease, the name of the ship, and the port for which it was bound.

[*For Discussion on this Paper see page 411.*]

PUBLIC HEALTH AND THE IMPERIAL CONFERENCE.

By FRANCIS FREMANTLE, M.A., M.Ch.(Oxon), M.R.C.P., F.R.C.S., D.P.H.

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(MEMBER.)

ABSTRACT.

THE last century was distinguished by the invention and organisation of new methods of rapid and distant intercommunication. Commercial competition is become a very serious element in the struggle for international existence. The prime factor is the physical co-efficient of national power, and there follows a general desire to avert the most preventible causes of disease and death. The first operations in this campaign are directed against epidemic disease.

This Congress and Institute are liable in sanitation (as is England in general) to take too parochial a view of their privileges, powers, and prospects. In order to survive in the future as the first sanitary body of the Empire they must realise that England is, in the future, to be but the predominant partner in a British Federal Empire. They will thereby gain enormously both in knowledge of their science, in possibilities of new and old methods, and in power to bring those possibilities into existence.

We talk a great deal of the glorious possibilities of the British Empire. It has grown up haphazard. We people of the motherland now see that the Empire is one of the greatest assets for England; but, in the struggles of nations, haphazard arrangements are of no use; the Empire, if it is to continue, must be organised. We talk, therefore, of Imperial defence, and of commercial bonds within the Empire—I venture to add the suggestion of Imperial defence against epidemic disease.

It is perhaps natural that our own offspring should teach us many lessons of the greatest importance in our task of Empire management; and, as we look for many internal political experiments to New Zealand, so we look for the result of many experiments in co-operation between different governments under one head to the United States of America.

The germ of this organisation in America is contained in the "United States Public Health and Marine Hospital Service," a service of Federal quarantine. This is an unique organisation, independent of Navy and Army, working under a surgeon-general and a central bureau at Washington, and superintending or at least supervising the health of every port in the United States. The Marine Hospital Service has its headquarter buildings and publishes its official documents in Washington, where it occupies in a small way the position of the sanitary department of our Local Government Board, or of the Ministry of the Interior in a Continental capital. The term Marine Hospital, as this building is called, is a misnomer. In Washington there is no marine, and this particular building contains offices and laboratories, no hospital; but it represents the department which has to do with quarantine and the protection of the seafaring mercantile community throughout the United States. It is the representative of a national board of health, and was established by an act of the United States Congress as a result of the panic created by the spread of yellow fever in the Southern States in 1878. Without interfering with the separate State legislatures, it has sent its commissioners to supervise the arrival of foreign persons and merchandise in thirty-nine established quarantine ports. Primarily directed against the foreigner, this system was in 1890 extended to the "enforcement of rules and regulations made by the Secretary of the Treasury to prevent the introduction of contagious or infectious disease into the United States from foreign countries, and into one State or Territory from another." If the local officials do not efficiently apply such regulations, the national Government has a right to appoint its own officials to enforce due observance of the rules, and to impose a penalty of $500 or two years' imprisonment.

Thus in 1901 at San Francisco the commercial community had done all in their power to disprove the existence of plague, and the Hon. Mayor Schmitz had tried in vain to dismiss the Board of Health for its outspoken declaration of the undoubted existence of plague to a dangerous extent. But in 1904, after three years' work, Past-Assistant Surgeon Blue and his colleagues of the Marine Hospital Service from Washington

had confirmed its opinion, had localised and stamped out the plague from San Francisco. He kindly showed me the basements in the Chinese quarter which they were concreting, and the insanitary hovels they were demolishing.

It is one thing, however, to prevent transportation or importation of disease; it is another to prevent such disease arising or taking root. It is just this power which is lacking at Washington. It involves some centralisation of sanitary administration, and, like the Navy and Army, it involves some restriction of local freedom.

The groundwork of administration is information, and this is obtained and issued by the Marine Hospital Service in the form of a weekly bulletin, which may well serve as a model for our own use. It consists of two parts, the first concerning the mainland of the United States, the second concerning the islands and foreign countries. In one number, for instance, the first part contains reports on tick-fever in the Rockies, on the work at San Francisco, on the discovery of the *Anopheles* mosquito in Key West, on smallpox along the Canadian border in Maine, on yellow fever in Texas, and on the inspection service along the Mexican border; vital statistics and the facts of health reports from various states and cities; reports of alien immigrants; tabular reports as to cargo and disinfection of arrivals or sailings from all national quarantine and inspection stations; ending with tables of smallpox, yellow fever, and plague throughout the United States, and the weekly mortality table from some sixty American cities. The second part contains detailed reports concerning the public health at every port of importance throughout the world. The report of plague in Cape Colony was only five weeks, that from Brisbane six weeks, old. Information was given as to immigrants rejected in Canada, as to mortality in Rio, as to smallpox in Bahia, as to the health of Limon (a fruit port in Costa Rica), and of Panama; and an outline of the problem to be confronted in one of the Cuban cities. A report from an assistant-surgeon in South China gave details of plague, smallpox, and cholera, in various provinces, of supposed rinderpest in Burmah, of quarantine maintained at most oriental ports against arrivals from Hong Kong. Most striking of all was the report from Manila, forwarding the best information, whether from ship captains or from official or other source, as to cholera at Saigon, plague at Hong Kong and Amoy, various dangers at all other ports in trade-relation with the Philippines, and the measures to prevent their transportation.

That this bulletin forms the nucleus of information, which might be of

the greatest value to the American commercial world, is beyond question. It is suggested that a similar weekly bulletin should be issued with the far greater resources of the British Empire.

Epidemic disease of a serious nature is a recognised subject of concern and report on the part of every responsible officer of our navy and army, of every British consul, governor of a colony, or member of the civil service in India, Egypt, or the African protectorates and possessions. It is now suggested that these officers should furnish weekly information on a systematized plan, for issue by an office in touch with all other government offices at home, and all other governments in the Empire.

Daily reports furnished to the meteorological office and daily charts and forecasts are issued. It is suggested that epidemic disease is not of less interest or importance than the weather, and that epidemiology may with advantage be given facilities equal to those of meteorology.

The registrar-general, already publishes weekly vital statistics of a few foreign and colonial countries and cities. The present suggestion is that this information be made far more comprehensive, regular, and direct; and that it be supplemented by facts which cannot be put in the form of statistics.

The Board of Trade, the Local Government Board, Somerset House, the Foreign, Colonial and India Offices, the War Office and the Admiralty all have valuable material for the purpose. The proposal now made, involves their co-operation with each other and with foreign and colonial authorities, by methods to be discussed at the forthcoming Imperial Conference.

If considered worth while, the conference could establish a weekly system of notification from every port and place of commercial importance throughout the world, where there is any British consul, ship, garrison, or representative of any sort. By Tuesday morning in every week, every British shipowner could know the epidemic risks he runs, by a report only three days old. The cost would be small, the direct gain to commerce considerable, the gain to epidemiologic science very great.

This paper has dwelt on the commercial advantage of the proposal, for the financial argument is the strongest recommendation of any public proposal. It has confined itself to the suggestion for a system of comprehensive information, for it is best to propose one step at a time. But we at this Congress must look further ahead. Mr. Chamberlain, Professor Ross, and Sir Patrick Manson have, during the last 15 years, initiated by their discoveries or practical suggestions the most important sanitary

movement of the world's history, in proposing the extermination of epidemic scourges in the tropics. As in this country the work of sanitary authorities is supervised and assisted by County Councils and the Local Government Board, so in the larger Empire the work of local sanitation should be aided by the larger experience of the Empire, for imperial as well as for local reasons. Port Swettenham was in three years converted from a pestilential swamp into a healthy and prosperous port. But had the colonial surgeon been a man of only common ability or possessed of less interest or knowledge in the matter of public health, had the civil authorities been less progressive, had local opinion been adverse, Port Swettenham might have remained a seething centre of infection; and any such centre may at any time become suddenly responsible for distributing pestilence throughout the entire world.

We want an Imperial Office of Health, with a staff of inspectors analogous in function and equal in prestige to that of the Local Government Board; and the personnel is ready to hand in the many medical officers of wide imperial experience, retired from the public services in the prime of their professional lives, and anxious for further work of an honourable kind.

As a preliminary step in this direction, I venture to propose "That this Congress do urge the Council strongly to represent to His Majesty's Government the desirability of submitting to the next Imperial Conference proposals for a system of imperial notification of infectious disease."

[*This Discussion applies also to the Paper by* DR. EDWARD WALFORD, *page 401.*]

DR. T. H. A. VALINTINE (New Zealand) said that he was particularly interested in the two papers, as his official duties often brought him face to face with the laxity or absence of notification between countries. He instanced the case of a ship from Calcutta, which arrived at a New Zealand port with smallpox on board; fortunately the disease was recognised, and only one case subsequently occurred in the Colony. Unfortunately, however, the vessel had previously visited a Tasmanian port. A widespread epidemic of smallpox followed in that Colony, whence the infection of the disease was reintroduced into a New Zealand town, where a considerable number of cases occurred. Inter-notification between the states of the Australian commonwealth, New Zealand, Cape Colony, and New Caledonia is rigorously observed. He was of

opinion that Dr. Walford's view as to a ship-master's plea of ignorance of disease on his ship was rather too lenient. In New Zealand such a plea would not save a master from prosecution. But the master is not so culpable as some ships' doctors he had come across, who had neglected to notify port health officers of the existence of illnesses of a possibly infectious nature. He was therefore in favour of a system of international notification as suggested by Dr. Walford, and had much pleasure in seconding Dr. Fremantle's motion as to the establishment of an Imperial Health Board, from which the various health departments in the Empire could take their time. He would have much pleasure in bringing the matter to the notice of Sir Joseph Ward, whom he believed to be the first Minister in the Empire to hold a portfolio in public health, and who would undoubtedly bring the matter before the forthcoming Colonial Conference.

Dr. D. S. Davies (Bristol) said that, generally, he supported the suggestion for international notification. Alarm as to infectious disease created panic, panic interfered with commerce, and it was sometimes thought to be in the interest of nations to suppress information. His experience in the port of Bristol for twenty years had shown him that the greatest reliance was to be placed upon careful inspection on arrival, especially in the case of the very mild cases of disease, the existence of which was not even suspected. For example, in one case a man with the smallpox eruption on him steered a vessel up the river into harbour. He (Dr. Davies) found that valuable information could be obtained, not only from the daily Press, but especially from the valuable publications of the United States Public Health and Marine Hospital Service. In general, he supported the principle of Dr. Walford's paper, though its realisation might be difficult to secure.

Dr. E. Davies (Swansea) mentioned a case of smallpox discovered in the port of Swansea two days after arrival from Antwerp. A previous case had been removed at Antwerp, and it was contended that the voyage to Swansea was a new voyage and that no offence had been committed by non-disclosure of the fact of the previous case. Hence the need for international information.

The resolution proposed by Dr. Fremantle and seconded by Dr. Valintine was put to the meeting and carried unanimously.

THE INFLUENCE OF MILK SUPPLY ON INFANT MORTALITY.

By J. M. FORTESCUE-BRICKDALE, M.A., M.D. Oxon.

A FEW well-known facts give importance to the relationship between the milk supply and infant mortality. 1. The birth-rate is decreasing. 2. The infant mortality rate is at least not decreasing. 3. The proportion of mothers who can suckle their children is decreasing. 4. The death-rate among artificially-fed children is much higher than among those fed on the breast.

The decrease of the birth-rate should be met *inter alia* by prompt measures to reduce infant mortality: and considering that the large majority of children dying under one year are artificially fed, the use and production of cow's milk must be considered as taking an important place in any discussion on this subject.

Now, broadly speaking, cow's milk may influence mortality in two ways: Either it may be bacterially impure, and capable of inducing disease, or, secondly, it may be physiologically unsuitable for infant feeding. It is under these two heads that I shall discuss the question in the following paper:—

I.—Bacteriology.

The bacteria occurring in milk are numerous and varied in character. For the purpose of the present paper we need consider only a few of them. Among the so-called pathogenic bacteria, many are occasionally found, and milk-born epidemics of enteric fever, diphtheria, etc., are proved to have occurred. The only ordinary pathogenic organisms, however, which are sufficiently important to be considered in a short paper such as this are the *B. tuberculosis*, and the organisms connected with infantile diarrhœa.

A.—*Tuberculosis.*

The *B. tuberculosis* is not only important owing to its influence on infantile mortality, but also owing to the immense amount of dis-

cussion and investigation which has recently been bestowed upon it. As is well known, Koch, the discoverer of tubercle bacillus, in 1901 denied the identity of the human and bovine bacilli, and on the strength of this view advised that no further measures should be taken to prevent cows suffering from tuberculosis contributing to our milk supply. The facts which Koch brought forward in support of his thesis were :—1. Certain morphological differences between strains of tubercle bacilli derived from human and bovine sources. 2. The impossibility of inoculating cattle with the human strain of tubercle; from which he argued that human beings cannot be infected with bovine bacilli. 3. The rarity of abdominal tuberculosis as a primary lesion in children. Of these three assertions, the first has been supported by investigators in all countries, and it is now admitted that two strains of tubercle bacilli exist having a different morphology. The second statement has not been supported, by any means. Various observers have succeeded inoculating cows with tubercle bacilli from human sources, though there are apparently great variations in susceptibility in different cases. Thus the German Government investigators in 1902 only succeeded in inoculating 10·7 per cent. of their cows with human tubercle bacilli; whilst the English commissioners reported success in 33 per cent. of cases (1903). Eber found cattle as easily inoculated with human as with bovine bacilli. The converse, namely, that bovine bacilli are not transmissible to man, has been amply disproved. Thus the German commission in examining fifty-six cases of tuberculosis found the bovine type in six, and these were all cases of primary intestinal tuberculosis occurring in children of from 1¾ to 6½ years. It was thus shown that bovine tuberculosis may cause death in man, and the likelihood of such an occurrence taking place had next to be considered. Here again we are met by a theory which, though advanced by one of the foremost authorities of the age, is at present not very generally accepted. Behring's view is that tuberculosis is almost invariably contracted in infancy, but that under favourable circumstances it may remain latent and eventually become extinct, whilst under unfavourable circumstances it may awaken into active disease at almost any period of life.

It may be conceded that the primary intestinal tuberculosis of the morbid anatomist is not very common. But there are further considerations. In the first place, together with the cases in which the source of infection can be proved post-mortem, every pathologist meets with a number in which the infection at the time of death is so general, that no

statement as to where it started can be made. Thus in Hand's figures, quoted above, out of 332 autopsies 115 showed some form of tuberculosis, in 23·4 per cent. of these the primary seat could not be determined.

It has also been abundantly shown that tubercle bacilli may enter the body in food otherwise than by the intestinal canal. Penzoldt showed that (as had been suggested by Hueppe) in the act of swallowing tuberculous material, the bacilli may lodge in the tonsils and so primarily affect the thoracic organs, and animal feeding experiments (rabbits and apes) have confirmed this view. Another point has been brought out by Macfadyen, who has shown that, in monkeys, bacilli of bovine origin are much less likely to produce lesions in the intestinal mucosa than those of human origin, though general tuberculosis may equally occur. Macfadyen and MacConkey have, moreover, shown that in the mesenteric glands of twenty children, dying from non-tuberculous diseases, virulent tubercle bacilli, as demonstrated by inoculation experiments, were present in 25 per cent., though they could not be detected by microscopical examination.

The extreme position adopted by Behring is not generally accepted. It is, however, admitted that children appear to be specially susceptible to the bovine bacilli, whilst pathologically the lesions are rather glandular and arthritic, and not those of the ordinary phthisis pulmonalis of adults. bovine bacilli is responsible for the forms of tuberculosis common in This has led Nathan Raw to the view that whereas milk infection with children, the adult type of phthisis is due to human bacilli taken into the lungs by aspiration. This also is the view of Theobald Smith. The bovine infection, if not too severe, appears to give some sort of immunity, as subjects of healed tuberculous adenitis or arthritis, seldom suffer from phthisis pulmonalis as adults.

It may well be that, as has recently been suggested, the two types, instead of being two separate strains, may really be merely modifications of the same bacillus, mainly produced by environment. Mixed infections, in which both forms are found, have been proved to exist, and Behring thinks he has proved the transmutation of one type into another in goats after a lapse of time, but accidental infection with the second type could not be absolutely excluded.

B.—*Infantile Diarrhœa.*

An overwhelming majority of the cases of infantile diarrhœa occur in artificially fed children. This fact is too well recognised to need elaboration here. It seems, therefore, that the substance used as a

substitute for mother's milk has some causal connection with the disease. The epidemic form of diarrhœa, which occurs in the summer and has a definite relation to the earth temperature, has been bacteriologically investigated in many countries, including our own. Briefly, it may be said, that in the United States the extensive research carried out under Flexner and Holt's direction by the Rockefeller Institute, showed that some form of *Bacillus dysenteriæ* was present in a very large number of cases, and was probably the causal agent. In this country H. de R. Morgan, at the Lister Institute, has found a special bacillus in a large number of the stools of diarrhœic infants, which differed from all known pathogenic organisms in its cultural characters. It produced experimental diarrhœa in young animals, but only when taken by the mouth. The *B. coli communis*, and also the ordinary *Streptococcus pyogenes* have been accused by various authors of causing summer diarrhœa in infants.

From another point of view various investigations have shewn that the causal agent in summer diarrhœa is conveyed to the patients in milk.

The bacterial contamination of milk may thus occur at any point in its production and distribution. In the udder of the cow it may be infected with pathogenic bacteria, such as tubercle; in the process of milking numerous organisms may be introduced such as those of ordinary microbic diseases, or those of the lactic acid or of the subtilis group. In transit or in the houses of the consumer, milk may become further infected by flies, dust, and dirt of all descriptions.

C.—*The Remedy.*

What, it may now be asked, has been proposed to meet this condition of things? Compromise and half measures are two striking characteristics of the nature of man. In the present case we are told not to insure a pure milk supply, but to disinfect the contaminated article. First of all the milk may be boiled or pasteurised, secondly it may be treated with some chemical, or thirdly it may be both heated and treated with chemical agents. The cooling of milk is an additional process, which insures more permanency to some of these half-measures.

We will now see how far any of these systems of converting base metal into gold are reliable.

1. *Boiling.*—Ordinary boiling in a saucepan does not raise the temperature of milk above 85° C., though by means of pressure apparatus, as in an autoclave, 100° C. or higher temperature can be reached. Boiling will kill off all ordinary pathogenic bacteria, but prolonged heating

is necessary to destroy spores. Prolonged heating is the plan adopted by many French authorities. Thus in Nancy, Michel first heats the milk to 90° C. for 49 minutes in a not absolutely closed vessel. The vessel is then sealed and further heated to 112° C. for 20 minutes. This milk is said to remain sterile indefinitely; bottles have recently been found in good condition which were sterilised in 1900. Variot sterilises his milk at 108° C., and states that among 3,000 children no scorbutus was noticed. About 4 per cent. developed anæmia and constipation. Milk heated to this degree has disadvantages for infant feeding which are more often insisted on in this country than in France. Dr. Ashby and others have called attention to the risk of infantile scurvy, and, as is well recognised, the "vital" properties of milk (which, though but vaguely understood, are certainly actualities) are destroyed in the process of superheating. There are also minor chemical changes the importance of which cannot at present be stated. If the milk is merely heated to about 70° C., as in pasteurisation, some of these objectionable features are diminished. From the bacteriological point of view it may be taken as certain that the non-spore-bearing pathogenic germs are killed. The spores of the peptonising subtilis group are however not destroyed, nor those of the butyric acid organisms. These last are also found in milk which has been actually boiled.

Hence pasteurisation can only be regarded as a means of making milk keep sweet rather longer than usual by destroying the lactic acid bacilli, and of eliminating certain ordinary pathogenic organisms. The same may be said of the addition of preservatives such as formalin. Dr. Aitchison Robertson has recently commended this process, advocating very small quantities of the chemical. He shows that the formalin has no effect on the test tube digestion of milk, but it remains to be proved that the ingestion daily of even small quantities is absolutely innocuous to infants. Backhaus states, in fact, that formalin, even in the smallest amounts, is injurious after a time. Moreover, there are very obvious objections to the addition of chemical preservatives to foodstuffs which are specially pertinent in the case of milk. Milk is used by the poorest and most ignorant, and is sold in small quantities, thus no regulations as to declaration by the vendor of the amount of preservative are likely to be practically efficacious. Could the article be universally made up into small packets, and clearly labelled, those consumers who could understand might learn what amount of formalin their milk contained.

Some years ago Macfadyen and Hewlett, recognising the difficulties

of actual sterilisation of milk, devised a process by which the milk was passed through a series of tubes and heated to 70° C. twice with a rapid intermediate cooling. The whole time occupied by any given small quantity of milk in passing through the apparatus was only 30 seconds. The pathogenic organisms, including tubercle bacilli, were killed, together with about 98 per cent. of the saprophytes.

As an example of pasteurisation, *plus* chemical disinfection, may be mentioned the so-called Budde process, which consists of passing through the milk peroxide of hydrogen. It is apparently very efficacious as a destroyer of bacterial life. Cooling to about 40° F. inhibits bacterial growth, and this fact is taken advantage of in the preservation of pasteurised and other milk. It is no doubt the keystone of the whole system of milk preservation without sterilisation, and has the advantage of preventing the germination of spores.

Calmette has recently shown that milk containing dead tubercle bacilli acts like a tuberculin, and given in repeated doses may prejudicially affect the health of infants.

It will thus be seen that from the bacteriological point of view, short of absolute sterilisation, there is little to choose between the various methods of milk preservation. Absolute sterilisation has many disadvantages from the point of view of infant feeding, and we are thrown back on the only scientific plan, namely, by the production of clean milk from healthy cows. The product should be kept in closed sterile vessels at a low temperature.

II.—Milk as an Infant Food.

The production of a pure, untreated milk is no doubt the main point to be aimed at in the reform of the milk supply, especially as regards the reduction of infant mortality from tuberculosis and summer diarrhœa. But at present, at any rate, this is not all. The conditions of home life and the ignorance of the simplest principles of infant feeding which exist among a large section of the community render something more an absolute necessity. The milk to be used for infant feeding has to be diluted and otherwise modified, and even a pure milk supply, could such a thing be universally secured to-morrow, would not ensure this. The effect of feeding children on physiologically unsound lines is mainly seen in the number of cases of marasmus and rickets which crowd the outpatient departments of our hospitals. Indirectly, as well as directly, these diseases increase the infant mortality, as many deaths from summer diarrhœa, bronchitis, &c., occur in marasmic infants.

The only existing organisations for meeting this difficulty are those known as the Infant Milk Depots. With the details of these institutions space will not allow me to deal at present, but I would point out that they begin where all other systems leave off. In many cases the milk supplied by Infant Milk Depots is heated, but this is by no means universally the case. At Rochester in the State of New York, at St. Pancras in London, and in Leeds an unheated milk is produced and found satisfactory. All that is needed is efficient control. With the general introduction of a pure milk supply, Infant Milk Depots will resolve themselves into stations for modifying and distributing the milk, and in the mean time they are not only actually the means of saving much infant life, but also a valuable object-lesson to the community at large.

SIR CHARLES CAMERON (Dublin) said although there was now an extensive literature on the subject of infantile mortality, so important was it that it could not be too much considered. As infantile mortality varied from 200 to 1000 births in some towns to 80 in others, it was evident that in some of them there must be a very excessive mortality of infants under one year, which certainly could by proper means be reduced. He considered that the high mortality was to some extent due to deficiency as well as defect of food. He had ascertained the amount of milk weekly used by several hundreds of families in Dublin, and found that the quantity purchased by many of them was insufficient even for the infant of the family. Starchy and other inappropriate food given to the very young in illness was another factor in causing disease. On the subject of the purity of milk, he considered that produced by town cows which were under proper sanitary supervision was freer from impurity than milk from the country. In Ireland, at least, the rural sanitary authorities practically did nothing in reference to the hygiene of the dairy. In Dublin, the whole time services of a veterinary surgeon were secured to inspect the cows, and see that the milk of diseased ones was not used. He had extensively examined milk from the country, and often found it to contain filthy matter. Although he considered that the sterilising and pasteurising of milk profoundly affected its albuminous constituents and rendered them less digestible, yet it was better to subject milk to those processes when there was uncertainty as to its purity.

DR. WILLOUGHBY (Eastbourne) objected very strongly to interference with milk by pasteurization, boiling, additions of preservatives, etc., but advised going to the root of matters and getting pure milk at the farms, keeping it pure right through, and giving it pure to the child. Even if preservatives were of no harm, and he believed they were harmful in themselves, they kept milk

longer liable to pollution, etc., and so were bad in that amongst other ways. He believed the true solution was to be found in proper attendance to farms and means of carriage, and not in tampering with milk.

Dr. William Butler (Willesden) said it would be difficult to exaggerate the importance of the rôle played by milk in infantile mortality. The numerous investigations of medical officers of health had placed beyond dispute the fact that the excessive mortality of infants was due to poisoned cows' milk. In his own district he was safe in affirming that from 100 to 150 infants perished each year from the contaminations of milk. The infants who died were those who were artificially fed; those who were breast-fed surviving in a much greater proportion. That important fact being established the practical question arose, What could be done to secure a milk supply pure enough to be used with safety for infants who perforce were artificially fed? And the first thing to be settled was where was the milk contaminated? He was of opinion that the most important contaminations were those contracted in the milk-shop of the retailer and in the home of the consumer.

Dr. Edward F. Willoughby (London) said all that Koch proved was that bovine tuberculosis was far more virulent than human to all animals, and if so why not to man also. No certain relation existed between path of entry and localisation of inspection; gastric secretion kills bacilli, but those that are arrested by tonsils infect bronchial glands and lungs. What was the vitality of milk? With the brilliant success of corporation milk and other sterilised milks, were they certain that the boiling is the cause of failures in others. Boiling did not act on casein, and was wholly different from added chemicals. The success of the Boston experiment with dried milk, when of 800 infants in the hot weather in the slums none died of diarrhœa. The physical character of the caseins was more important than the percentage of constituent. Asses' milk was digested by feeblest and premature infants because its casein resembled the human, not the ruminant, though in its great deficiency of fat it would appear unsuited. But a standard of human milk was unattainable. Koch showed that fourteen healthy mothers with healthy milk showed an enormous range of composition, and suggested that there was a relation between each mother and her child, and one might add as many children, so many standard milks.

Lieut.-Col. A. M. Davies (London) said that it appeared to be hardly possible that dried milk could be re-transferred into what can be called genuine milk. How could each minute globule of milk fat be again coated with a delicate pellicle of albuminous matter? Undoubtedly the milk fat was there, but it was not there in the form in which it was required by the infant organism, viz., a very fine emulsion, What he found on microscopic examination

was that there was a mixture of oil globules and water, etc., but not the very fine emulsion that constitutes genuine milk.

DR. J. M. FORTESCUE-BRICKDALE (Clifton) said, in reply, he would like to point out that sterilised milk powders and dried or condensed milks being highly manipulated articles were to be regarded as unsuitable for infants, except possibly for a month or so during very hot weather, for a journey, or under some other exceptional circumstances. Moreover, they were apt to be deficient in fat, to form bad emulsions, and unless sent in sealed packages were liable to contamination in transit. He thought, with regard to intestinal infection of children, Dr. Willoughby had slightly misunderstood his paper; a reference to the text would show that he did not think post mortem evidence of any value in determining the true incidence of tuberculous infection by milk. With regard to boiling, it was unwise to advocate too enthusiastically a system which might prevent proper measures being taken to insure purity at the fountain head.

PREVENTIVE MEDICINE AND THE INDIVIDUAL.

By CHARLES J. WHITBY, M.D.

ABSTRACT.

THE Public Health Service, working upon the general environment, aims at preventing the disease of all, while the private practitioner, studying constitutional peculiarities, endeavours to cure the maladies of each. A closer alliance and a greater unity of aim as regards these two branches of the medical profession is desirable. There is a personal side to preventive medicine which cannot be safely ignored, if we are to succeed in our aim of raising the general health and efficiency of the nation to the highest possible pitch. The most pressing problem is that of our infant mortality, nearly treble (pro ratâ) that of the community as a whole, and constituting, therefore, a disgrace which must be removed. We have as yet no means of calculating the relative part played by its conjectured causes. We want to know not merely the immediate cause of each child's death, but all the hereditary and environmental conditions which have led up to it. Such knowledge is already possessed by the private practitioner, and from him alone it can and should be obtained. When such a man dies, the fruits of his knowledge and experience die with him and are irreparably lost. Infant mortality being a matter of urgent public concern, the investigation of its precise causes is a public responsibility. A great many of the children who perish prematurely ought never to have been born, but at present we cannot say which, and have not, therefore, earned the right to interfere. What are suitable or unsuitable marriages? Are there various types of health, some productive of good, others of bad results in marital combination? Medicine is or should be a branch of biology. No form of merely voluntary investigation will prove adequate to our needs. The private practitioner must be paid to collect the information we require, so that we may learn the conditions of success. For the purposes of statistical comparison we must know the conditions under which every child is born and nurtured, and the progress made by it during the danger period; its first five years. An enquiry form, to be posted up at stated intervals by the practitioner of their choice, might be handed to the parents on registration of

the birth. The age and constitution of the parents, their general circumstances, the condition of the child at birth, the number and health of their other children, and the proposed method of nutrition, would be first ascertained. Future entries would record the progress made by the child, its ailments, and the modifications of dietary. Advice would be given, if required, on each occasion. The appointment of district medical informants would not suffice; it is essential to safe-guard the parental right of choice, and to secure the intimate knowledge possessed by the family doctor alone. A reference number might replace the name of the child on the form, and due regard to secrecy should be observed. The expense of such an enquiry would be compensated by a speedy reduction in infant mortality, as well as in doctors' bills. The science of heredity would be greatly forwarded, and an important step taken towards the diversion of the medical profession into the channel of preventive work. We should be in a fair way to improve not merely the acquired but the inborn qualities of the race.

The same principles are capable of much wider application. The increase of lunacy may be due either to social and economic stress or to innate degeneracy. Asylum statistics cannot solve the problem; we need for comparison records of analogous cases, in which the catastrophe is escaped. So with tuberculosis. A closer study of its hereditary element or premonitory signs might enable us to identify and fortify in advance its probable victims. Against alcoholism we shall be helpless until the disease has been tracked to its root in an ill-developed or degenerate stock, the propagation of which is a crime. Syphilis in one or both parents might, if its effects on the offspring were known, justify legislative restriction of matrimony. In all such matters preventive medicine must rely on a study of the individual, and the private practitioner is entitled to a share in the work.

The same system of periodical notification suggested for infants, might, at longer intervals, be extended through adult life. Every member of the community should have his or her health-dossier. The money spent on this would prove a good national investment. Precise anthropometric methods would be evolved, and we should ere long be able to indicate the natural vocations of most individuals. The compulsory notification of hereditarily-transmissible diseases or defects is no less justifiable than that of infective fevers. The birth of the unfit cannot be checked until its inevitability under given conditions can be fully proved. We are very far as yet from the realisation of that eugenic religion which haunts the dreams of the twentieth-century sociologist.

THE STANDARD OF HOME LIFE AND THE INFANT MORTALITY PROBLEM.

By Miss MARION FITZGERALD,

Lady Sanitary Inspector, Derby.

(ASSOCIATE.)

IT must be the opinion of everybody engaged in work connected with the infantile mortality problem, that that problem is a very complex one and that its contributing factors are very far from being completely understood. However, while we wait for fuller light, we do know that feeding has a very considerable influence, and that the hand-fed child comes out badly in the struggle for existence. Moreover, great and amazing is the ignorance of women in the matter of child-rearing. Hence, an obvious duty devolving upon the community and resulting in the work undertaken by the municipalities in the direction of instructing the mothers; and while their appointed officers carry out this task, vast stores of information may be incidentally accumulated, which when tabulated should be the means of contributing to much fuller knowledge on the subject.

There are several lines of investigation open to those engaged in the routine work of visiting homes after registration of births. Speaking generally, I should say that they are of a sociological rather than a purely scientific nature, and the method is one of observation rather than research. I only offer details of one line of investigation which is directed towards calculating the death-rates of infants, and the incidence of the causes of death, *according to the classification of their homes;* the condition of the home being regarded as an index to the type or grade of the inhabitants. This classification will be better understood if I explain the circumstances which led to its adoption in Derby.

In investigating deaths of infants from summer diarrhœa it was ob-

served how neavy was the incidence upon the better-class of home, and yet at the same time there were a considerable number of hand-fed or partially hand-fed infants in homes of varying degrees of dirt and disorder, kept under constant supervision and visited frequently, chiefly on account of the slovenly incapacity of their mothers. Deaths from diarrhœa amongst these infants, who were obviously exposed to great danger, were by no means common.

Looking up my predecessor's reports on diarrhœa deaths in the summers of 1902 and 1903, I found her reports to be in agreement with my own, so that idiosyncracy of observation does not account for the preponderance of clean homes over dirty ones in this investigation.

Of a total of 151 diarrhœa deaths investigated in the summers of 1902 to 1905 inclusive, 108 occurred in clean or very clean homes; 34 occurred in fairly clean homes; and only 9 in dirty homes. The different kinds of sanitary conveniences do not seem to have exercised an influence.

Mrs. Franks, the Chief Lady Sanitary Inspector for Sheffield, has very kindly supplied me with the results of similar investigations made in Sheffield which strikingly confirm my own. Mrs. Franks informs me that of a total of 778 deaths of infants from diarrhœa occurring in Sheffield in 1901 not one occurred in the insanitary Crofts area subsequently demolished. And of these 778, only 106 occurred in dirty houses.

It seems clear that so far as the incidence of summer diarrhœa upon the different classes of houses is concerned, tht the unexpected happ ens; that there is something yet to be explained, and the question arises, what is the distribution of hand-fed and partially hand-fed infants into satisfactory and unsatisfactory homes? For this reason it was decided at the beginning of this present year to adopt a classification of the homes in reporting upon visits made after the registration of births. The card-index system makes it possible to keep several distinct lines of investigation going at one time, and to compile the results with a minimum of trouble. Extracting information of this kind, involving very large numbers, from an ordinary register is a long and tedious task.

Each infant has a card to itself recording its name, address, date of birth and condition, and, should it die, its death. The mode of feeding is indicated by the colour of the card: there is a range of six colours. Such facts as whether the infant is a first-born child or not; if its mother goes out to work, either regularly to a factory or occasionally to do a day's washing or charing, are noted. In addition to this information, a mark is put upon each card denoting the class of home. We have adopted the very simple device of cutting off the corners to indicate the class, such a

method rendering sorting and compiling very easy. The division is into three classes. In the first, the habits of the people are degraded, cleanliness and decency are lacking, and the houses are structurally defective, dirty, ill-ventilated or overcrowded. In the second, the conditions are still unsatisfactory, although not to so great a degree; and houses structurally capable of being made into decent homes are debased by the negligence and incapacity of the women. This class occupies a middle-way between sheer degradation and the minimum of a decent standard of living. The influence of alcohol is certainly implicated in the first class and most probably in the second also, but it is not easy to estimate its extent. The third class exhibits signs of good housewifery, cleanliness and love of order; the dwellings are structurally satisfactory or are made the best of by the ingenuity, industry and perseverance of the tenant. All above this minimum are included in class 3. If a further class were made it could only be based on a greater margin of comfort, which is departing somewhat from the original plan.

It is obvious that a classification of this kind presents some difficulties. The divisions must be fairly broad, for matters pertaining to human life are very difficult to pigeon-hole. At the same time they must be definite enough to admit of agreement on the part of different workers. The classification is the result of a personal estimate of each home. It does not depend primarily upon locality, size of house, occupation of the husband, or family income, so much as upon evidence of habits of sobriety and industry, and the judicious use of the money earned. It has this advantage, that being based upon observation, it can be pursued without categorical questioning, a mode of procedure to be avoided as far as possible. For investigations in infant mortality, I think this method has a sounder basis than one having reference to the poverty line. It implies both considerations of hygiene and of character. What is sought is some index to the *grades* of the people, and from that basis to calculate the infant death-rate in each grade, and in addition, the incidence of the causes of death according to each grade. A good deal has been said about diarrhœa, but that is merely on account of the apparent anomaly in that direction having suggested the idea of a classification. There are those other causes which bulk so largely in the infant mortality rate, debility and prematurity. It would be interesting to know in which of these strata of human society are born those children whose lives flicker out within a few days of birth.

It is not claimed that the scheme has yet passed beyond the experimental stage. Probably it will have to be subjected to modification or

enlargement. But I think the reasons set forth for undertaking it indicate that in this direction there is a field for profitable observation, although it will be merely supplementary to the more purely scientific lines of investigation.

SIR CHARLES CAMERON (Dublin) said that the paper was most interesting. He would ask Miss Fitzgerald a question. She said that of 151 cases of infantile diarrhœa, 108 occurred in clean or very clean houses, 34 in fairly clean, and 9 in dirty houses. This would appear to shew that the cleaner the house the more likely diarrhœa to occur in it. This paradox perhaps might be explained by there being a very small percentage of the total houses in the dirty class. It would be desirable for the Registrar General of England to do as the Registrar General of Ireland did: give the occupations of the decedents. In Dublin there was an extremely small infantile mortality amongst the groups of the independent classes and the professional classes, while amongst the general service classes and labourers the mortality was more than 200 deaths per 1000 births. As regards hand-fed children, he might reply that ladies now chiefly nursed their infants vicariously, which proved that when hand feeding was properly conducted it was by no means so bad as it was believed to be. He had seven children who were all hand-fed, and were stout, hearty, and fat.

DR. J. M. FORTESCUE-BRICKDALE (Bristol) said he should like to know how far the following factors could be considered as contributing to the fact reported by Miss Fitzgerald: (1) incidence of artificial feeding in both classes, especially with regard to patent foods; (2) occurrence of predisposing marasmus; (3) season of birth, as affecting age of child when exposed to zymotic enteritis. His experience at the out-patient department of the Children's Hospital made him think marasmus and hand feeding very common among well-to-do artizans.

DR. W. H. SYMONS (Bath) said since the introduction of the Midwives Act every inspector under the Act had had it in his power to get information of births within twenty-four hours without fee and without injustice. In Bath they supplied the midwives with cards bearing all the particulars required by rules of the Central Midwives' Board, and they were asked to fill in those particulars (except as regards the condition at end of ten days) and send in the stamped addressed envelopes as soon as possible. The sub-registrars were also supplied with cards, and he got a daily return of deaths and births from them, the cards being the official copy of certificates. Cards should be of different colour for different districts rather than for different diseases, as then they are filed out automatically in districts. An inquiry should be held concerning the deaths of

all children under one year of age; persons could generally be made ashamed of an infant dying.

Dr. D. S. Davies (Bristol) said a speaker suggested that the explanation was possibly in part that the very poor were more motherly, *i.e.*, devoted more intimate attention to their infants than those in a somewhat better position. The importance of the work that could be, and had been, done by the employment of lady inspectors in many towns was emphasised, and the speaker regretted that Bristol had not yet seen its way to appoint them; but stated that public opinion was changing, and there was a possibility of obtaining their valuable assistance in the near future in the class of work for which they were especially suitable, supervision of female labour in factories, of feeding of infants, etc.

Mrs. Gertrude Franks (Sheffield) said she endorsed what Miss Fitzgerald had said in her paper *re* the deaths from summer diarrhœa in Sheffield during 1901. Out of 778 deaths visited, 643 occurred under one year of age, 162 were first children, and only 106 occurred in dirty houses. The industries of Sheffield being heavy do not lend themselves to women labour, because only 62 of these children were put out to nurse. She must say that a larger proportion of the children in the better homes were hand-fed, but as reasonable precautions were taken in these homes, it should in some measure counteract the disadvantage of hand feeding. Her experience as inspector of midwives had led her to the belief that many of the children were tampered with both before and also at the time of their birth. This reduced their vitality and made them more susceptible to anything that presented itself.

Dr. S. G. Moore (Huddersfield) pointed out that the general practitioner might at least in one direction help preventive medicine very usefully. He might realise that the newly born infant is very susceptible to adverse influences, and he might dispel some of the ignorance which at present exists among mothers. When the speaker first examined infant mortality systematically some years ago, he considered it worth while to find out the mortality among newly born lower animals, for the purpose of comparing this with the human rate. Though among animals of considerable commercial value, the mortality of the newly born is very small, *e.g.*, very few pedigree racehorse foals die, still the deaths are commonly very numerous among the newly born lower animals, pointing to the fact that all very young living things are very susceptible to adverse external influences. It would therefore be a good thing if the practitioner would, as well as seeing that the mother had recovered from the confinement, extend his attention to the infant, and attempt to secure for it a good start in life.

Miss Fitzgerald (Derby) said, in reply, that the apparent anomaly was completely accounted for by the greater number of hand-fed children in the

better class of home. It was pointed out that the question was practically concerned with hand-fed children only, and that the object of seeking to ascertain the distribution of hand-fed or partially hand-fed children into satisfactory and unsatisfactory homes was to ascertain if the incidence of epidemic diarrhoea was *actually* and not apparently higher in the better class of home, and whether the slum child did manifest a higher degree of resistance to this particular disease than the more delicately nurtured child. If the slum children were numerically less, their points of exposure to danger in this particular respect were ten times greater; the mothers of the lowest class bought milk of worse quality, stored it more imperfectly, and more frequently mixed it with cheap pernicious patent foods than did the mothers of the more respectable class. In reply to Dr. Moore, she said that vast stores of information as to the causes of death did of course exist in every Public Health Department, but she believed that no attempt had yet been made to classify infant mortality on a sociological basis. The object of such a classification of infant life was to determine the death-rate in each grade and *the incidence of the causes of death* (supposing any marked difference to emerge) according to each grade.

PREVENTION OF TUBERCULOSIS:

A NEW MILK SUPPLY.

By Mrs. C. HAMER-JACKSON.

(ASSOCIATE.)

ABSTRACT.

IT has been established that though, in many cases of infantile mortality, deaths are due to inherent diseases inherited from such causes as the intemperance and immorality of the parents, defective feeding is responsible for no less than 50 to 60 per cent. In every hundred children who die before they attain the age of twelve months, more than one half could be saved if proper means were employed. Only 35 per cent. of mothers are able to nurse their infants, therefore mixed and artificial foods are necessary, and it is here that we encounter the great stumbling-block in the rearing of infants.

Sterilised milk and patent foods, according to some of our best physicians, are not to be relied upon. If we analyse human milk, we find the chemical composition vastly different from cow's milk; and this explains the difficulties in rearing infants on cow's milk. Chemists and scientists have tried to alter cow's milk, and have invented patent foods which they thought would be similar to human milk. This has, however, proved in many cases a failure, for this reason, that the milk which nature provides for the new-born babe is not only composed of certain chemical elements necessary to its nutrition, but it contains as well a living ferment which effectively augments the assimilative properties. It is this ferment which human science cannot at present create artificially.

The question resolves itself into the following:—to produce a milk resembling in chemical composition and physiological properties that which a babe imbibes at its mother's breast, it must be a complete food given at human temperature and containing those principles necessary to

its assimilation by the infant, and adapted to the delicate health of such as can only live on milk.

Cow's milk, with its innumerable dangers of tuberculosis, diphtheria, typhoid, and other fevers, is certainly not to be recommended. Everyone knows the danger of consuming cow's milk before it has been sterilised by boiling; but then, and this is the crucial point, is it the complete food, living and vivifying, which is necessary for our infants when they cannot get milk from their mother's breast.

Cooking at high temperature destroys the pathogenic micro-organisms, but it leaves the toxins which they created, and it eliminates the ferment necessary to digestion, besides transforming into an insoluble matter the phosphatic salts contained in the milk. We can all imagine the modifications brought about by cooking in the properties of an article of food, and compare the difference in taste, flavour and digestibility when raw (such as eggs, fruit, meat, etc.), and when they have been submitted to the action of heat. Cow's milk after it has been cooked has lost its hygienic properties, and is not fit food for infants.

Twenty-five years ago the Société Nationale d'Hygiène in France found in goat's milk the ideal food for infants, and has worked ever since to educate the people to the advantages offered by this little animal so despised by the general public. Without going into the history of goats from the time when they were worshipped by ancient Greeks and given a place in mythology, we find that in the last twenty-five years most of the eminent physicians on the continent have united their efforts to improve the status of the goats, and lastly, the Paris Académie de Médecine at its meeting of April 22nd, 1902, passed a resolution advising the creation of goateries in all French towns where pure and fresh milk could be had at all times. To give the qualities of goat's milk and the medical possibilities of this natural food would require a big volume. It will suffice to mention that goat's milk is absolutely free from tuberculosis, and is the only milk which contains the same living soluble ferments as human milk, some of which are capable of transforming fats into fatty acids and glycerine, and others starch into sugar, qualities priceless in the feeding of infants.

The many goateries established by the French Government have also proved that infantile enteritis is almost unknown where children are fed entirely on goat's milk, and in the south of Europe where the milk is supplied only by goats, tuberculosis and enteritis are extremely rare.

The price of a goat is within the means of every cottager, the food is a question of about 2d. a day, and this accommodating little animal can

even live and prosper in the back yards of the town. This question is well worth the attention of all those interested in infantile mortality.

Per 1,000 Grammes.

	Good Human Milk.	Goat's Milk.	Cow's Milk.
Casein	15 to 25	24·10	33 to 35
Butter	38 to 40	37·40	37 to 41
Sugar of Milk	50 to 60	50·38	50 to 52
Salts	2 to 5	7	4 to 6

[*The Proceedings of the Congress will be continued on page 445.*]

THE INFLUENCE OF THE SALINE CONSTITUENTS OF SEA-WATER ON THE DECOMPOSITION OF SEWAGE.

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IN considering the action of sea-water on the decomposition of sewage, it may be of some importance to ascertain the influence of the principal saline constituents, and how far this influence is exerted, not only by the separate salts, but also by the sea-water when it is sterilised and when it is unsterilised. The aim of the following experiments is to show how far the salts dissolved in sea-water affect the decomposition into simpler forms of the highly complex constituents of sewage, and particularly with regard to the production of nitrates as a final product. The aim of any efficient system of sewage disposal is to break down as rapidly as possible the various complex compounds, so as to produce finally an innocuous non-smelling effluent whose possibilities of future nuisance are reduced to a minimum. The decrease in the amount of the free and albuminoid ammonias, and the increase in the amount of nitrogen as nitrates, are usually considered to be measures of the purification; and the following experiments describe the results obtained in these three directions when sewage is incubated with several of the principal saline constituents of sea-water, and with sea-water itself both sterilised and unsterilised.

Dr. Adeney's and Dr. Letts' investigations on sea-water and sewage as reported in the evidence of the Royal Commission on Sewage Disposal, Vol. 2, did not attack the problem in the manner to be described, and we point out later several ways in which our methods differed from theirs.

As is well known, the chloride of sodium greatly preponderates over all other salts present in sea-water; and it is estimated to be present in the proportion of 28 parts per 1,000 in a sample of water taken from the British Channel. The chloride and the sulphate of magnesium also occur

in considerable quantities, being estimated at 3·6 and 2·3 parts per 1,000 respectively. Amongst other salts present in smaller proportion the chloride of potassium and the sulphate and carbonate of calcium may be mentioned, and this research will be extended to them at a later date.

For the purpose of this investigation the experiments were confined to the action of solutions of NaCl, $MgSO_4$, and $MgCl_2$.

An analysis of sea-water from the British Channel is given below. There are variations between such a sample and one taken from the Irish Sea or the North Sea; but as some standard is necessary for making the laboratory solutions, this analysis was adopted from which to make up the solutions of the three salts.

Sea-Water of British Channel.

NaCl	28·00	parts per	1,000.
$MgSO_4$ ...	2·30	,,	,,
$MgCl_2$ ...	3·60	,,	,,
$MgBr_2$ ...	·03	,,	,,
$CaSO_4$ ...	1·30	,,	,,
$CaCO_3$ ...	·03	,,	,,
KCl	·74	,,	,,
Water ...	964	,,	,,
Iodides ...	Traces.		

It is of some importance to notice that in the Irish Sea the amount of $Mg(NO_3)_2$ is given by Thorp and Morton (*Jahresb. für Chimie*, 1870, p. 1380) as ·002 parts 1,000. If the N is calculated from this, it will be seen how excessively small it is, being less than 0·04 parts per 100,000. It is difficult to conceive that this represents the final product of the nitrification of the nitrogenous compounds which must have been poured into the sea, in addition to the decomposition products of dead organisms. It seems to show that the ultimate nitrification to nitrates is seriously hindered, and the following experiments prove that such hindrance takes place when the various saline constituents of sea-water are incubated with sewage.

Method of Experiment.

In the course of the following experiments, laboratory solutions of the NaCl, $MgSO_4$, and $MgCl_2$ respectively were made up with distilled water of such strengths as to be equivalent to that of the corresponding salts found in the above sea-water.

Thus 28 grams of chemically pure sodium chloride were dissolved in distilled water and the solution made up to a litre. The $MgSO_4$ (2·3 grams per litre) and $MgCl_2$ (3·6 grams per litre) were made up similarly.

In the case of a salt like $MgSO_4$ it was, of course, necessary to allow for the water of crystallization ($MgSO_47H_2O$) in weighing out the required quantity. The $MgCl_2$ was carefully dried in a dessicator for some days before being weighed, as the salt is very deliquescent.

A sewage was analysed for the amounts of the free and albuminoid ammonias, and nitrates and nitrites already present, and it was then treated with the individual solutions of the salts so that each solution contained 1 per cent. of the sewage. One litre of this 1 per cent. solution of sewage in each saline solution was placed in a Winchester quart bottle. It was well shaken to insure thorough aeration of the contents.

During the incubation of the 1 per cent. sewage the Winchester quart bottles were kept at a uniform temperature of 16° C. The neck of each bottle was loosely closed by a plug of cotton wool, and the bottle and its contents were shaken from time to time.

As regards the amount of oxygen absorbed from a known strength of a solution of potassium permanganate, it was attempted at first to use Tidy's process, but there appeared to be some doubt as to how far this method could be relied upon in these experiments. The potassium permanganate might act not only on the organic matter, but also upon the chlorides dissolved in the water; and if there is any action, which has not been disproved, the figure obtained would not indicate the oxidation of the organic matter only, but also a proportion of the dissolved chlorides. Therefore it was decided to neglect Tidy's method, and to rely on the figures obtained from the free and albuminoid ammonias and of the nitrites and nitrates as representative of the changes occurring in the sewage.

The two ammonias were estimated by Wanklyn's method, and nitrites by the meta-phenylene-diamine method.

With regard to nitrates, three several methods were tried in order to see which gave the most satisfactory results. It is obviously of great importance to apply the most exact method in determining small quantities of nitrates.

1. The zinc-copper couple was tried in the usual way, but it was found to be uncertain and unsatisfactory. It appeared as if this couple acted not only in the reduction of nitrates to free ammonia, but also upon the albuminoids; for, on distilling the diluted and reduced solution, the boiling was continued until only a few cc. were left in the retort and the free ammonia was still coming over. There seems to be no doubt that in such a rich solution the zinc-copper system does not confine its action to the reduction of nitrates to ammonia, but that it also breaks down the

albuminoids to simpler forms, and that free ammonia is one of these products. The final result is that what should be considered ammonia derived from the reduction of nitrates is also ammonia produced from the decomposition of complex albuminoid compounds, and the figure obtained for nitrates is correspondingly high. We consider that the method is inexact because of this, and it was discarded.

2. With regard to the phenol sulphuric acid method, a known strength (·05 parts of N per 100,000) of KNO_3 solution was added to a definite volume of sea-water. This was allowed to stand for twenty-four hours and also forty-eight hours, and then its presence determined in the usual way by phenol sulphuric acid. We could not detect this quantity, and there may be two reasons to explain it. Either the action of the acid is affected by the presence of the salts in solution, or the KNO_3 is used up in oxidising the dissolved organic matter in the sea water. Besides that, the charring of the organic matter by the sulphuric acid interferes with the production of a well-marked yellow solution of the dissolved picrate.

Another strength of KNO_3 solution was also added to a known volume of sea water. This KNO_3 solution represented one part of N per 100,000, and it was allowed to stand for twenty-four hours and for a month. The KNO_3 was determined after these two periods and could be detected, except that great accuracy in determining the exact amount was difficult, because of the sulphuric acid charring the organic matter and the consequent mixing of the yellow colour of the picrate with a brown tinge. But there appeared to be a definite decrease in the amount of nitrate. It was therefore concluded that this method could not be used for the determination of small quantities of nitrates; for by it we could not detect the presence of 0·05 parts of nitrogen as nitrate in a solution of sea water.

3. Finally the indigo method was investigated, and its limitations with weak solutions. We found we could detect nitrogen as nitrates added to sea water in strengths not less than ·005 parts per 100,000; so that in our experiments the value of the nitrates was estimated within these limits; that is to say, if there was nitrogen as nitrates present in the incubated sea water, they must have been in less quantity than ·005 parts per 100,000. *We found that we could easily estimate nitrogen as nitrates when in solution in sea water in the proportion of ·005 parts per 100,000, but the results were unsatisfactory with any proportion below this.* This method was chosen, as it seemed to give more satisfactory results in determining small quantities of nitrates. As is well known, its principle

is based upon the direct oxidation of the indigo by such oxidising agents as nitrates.

The sewage samples were collected at the sewage farm at Cambridge from the settling tank near the outfall sewer, and nearly always about 3 p.m. in the afternoon. As the Cambridge sewage is a domestic one, and trade effluents do not enter into its composition, it is a remarkable fact that all the collected samples showed very high free and albuminoid ammonias, and almost an absence of nitrates.

Before proceeding to describe the experiments, it may be advisable to indicate the points in which the methods of these investigations differ from those of Dr. Letts, as reported in the Royal Commission on Sewage Disposal. The samples of sewage used by Dr. Letts in his experiments were weak as regards the ammonia figures, and in addition to this they were filtered before they were incubated in the 1 per cent. solutions. The sewage in these experiments was far stronger in free and albuminoid ammonias, and, though well mixed, it was not filtered, as it was desired to imitate as far as possible the natural course of events when sewage is turned into the sea or a tidal estuary.

As regards the important question of the ultimate nitrification, it is concluded in Dr. Letts' paper that the nitrifying organisms can exist and carry on their work in sea-water; but that it is remarkable that such a large proportion of free ammonia remained unnitrified after eleven months. In the later experiments it is admitted that the nitrates present at the commencement of an incubation of 1 per cent. sewage with sea-water, after a lapse of twenty-one months have entirely disappeared, or as it is stated in the evidence, "complete denitrification had occurred" (p. 481). On the other hand, if any nitrate was produced, may it not have been used up in oxidising the organic matter in solution? It will be shown in these experiments that the salts in solution in sea-water apparently affect the nitrifying organisms, for neither nitrates nor nitrites are produced at any stage of the incubations.

EXPERIMENTS.

In the first series (Experiments I., II., III., IV., V., and VI.) solutions of the three salts before mentioned were respectively incubated with 1 per cent. of Cambridge sewage. The two ammonias, nitrates and nitrites, were estimated at the end of 24 hours, 48 hours, and 17 days respectively; and the results of the analyses showed (1) that in each salt solution the total amount of the two ammonias was more than trebled in 48 hours, and afterwards there was a very slow production, even after 14 days' incu-

bation; (2) that the NaCl solution appeared to assist in the production of a larger proportionate rise in the albuminoid than in the free ammonia; (3) the largest total effect appeared to be produced by the $MgCl_2$ solution, but the differences were not sufficiently marked to draw definite inferences; (4) the stronger NaCl solution appeared to have the same influence as the weaker $MgSO_4$ solution; (5) the formation of nitrates and nitrites appeared to be entirely checked; and that there was an actual disappearance of small traces of these two bodies in one or two sewage samples. The following table gives the results of Experiment V. as representative of the others. The results are in parts per 100,000; 48 hours' incubation.

Solutions.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates and Nitrites.
Original Sewage	0·31	0·136	0·446	Trace.
NaCl solution ...	0·76	0·660	1·520	Absent.
$MgSO_4$ „ ...	0·90	0·500	1·400	do.
$MgCl_2$ „ ...	1·14	0·460	1·600	do.

And in the following table are the results of the incubation of the NaCl solution (Experiment III.), in parts per 100,000, and extending over 15 days.

Time.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates.	Nitrites.
Commencement	0·36	0·09	0·45	Trace.	Absent.
2 days	1·30	0·58	1·88	Faint trace	do.
10 „	1·00	0·28	1·28	Absent.	do.
15 „	0·90	0·30	1·20	do.	do.

In another series of experiments (Experiments VII. and VIII.) a 1 % solution of sewage was incubated with a *mixture* of the three salts; and analyses made after 1 day, 2 days, 3 days, 5 days, and 8 weeks. The results showed (1) that the total ammonia continued to rise until the third day, when it was four times greater than at the beginning, and after that, there was a gradual fall, and (2) that there was no appearance of nitrates or nitrites. The following table gives the results of Experiment VIII. in parts for 100,000:—

Time.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates and Nitrites.
Commencement ...	0·346	0·078	0·424	Absent.
1 day	0·980	0·550	1·530	do.
2 days...	1·100	0·650	1·750	do.
3 „	1·130	0·650	1·780	do.
5 „	0·960	0·630	1·590	do.
8 weeks	0·950	0·360	1·310	do.

In another series of experiments (Experiments IX., X., and XI), a 1 % sewage was incubated with samples of sea-water obtained from Lowestoft and also from Stalham off the Norfolk coast, and analyses were made after 1 day, 2 days, 3 days, 6 weeks, and 8 weeks. The results were (1) there was only a small rise in the total ammonias by the end of the 3rd day, and then a gradual fall to the original figure by the end of the eighth week, and (2) there were neither nitrates nor nitrites produced at any period. The following table gives the results of Experiment X., as typical of the others, in which the sewage was incubated with sea-water from Stalham :—

Time.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates and Nitrites.
Commencement ...	0·32	0·12	0·44	Absent.
1 day	0·40	0·13	0·53	do.
3 days...	0·36	0·17	0·53	do.
8 weeks	0·32	0·11	0·43	do.

In another series of experiments (Experiment XII., XIII., and XIV.), before incubation the sea-water was sterilised in an autoclave for 2 hours at 20 lbs. pressure and 126° C. It was then incubated with 1 per cent. sewage at 16° C., and analyses made after 2 days, 3 days, 5 days, and 8 weeks. The results showed (1) the increase in the total ammonia figure after 3 days was nearly three times the original amount in the Lowestoft water, and more than twice the original amount in the Stalham water, and that afterwards there was a very slow decrease, and (2) there was no production of either nitrates or nitrites. The following table shows the results of Experiment XIII. as typical of the others :—

Time.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates and Nitrites.
Commencement ...	0·32	0·12	0·44	Absent.
36 hours	0·60	0·27	0·87	do.
3 days...	0·65	0·31	0·96	do.
8 weeks	0·55	0·27	0·82	do.

It appeared that after sterilisation the sea-water influenced the decomposition of the sewage not unlike that of the artificial laboratory solutions, the sharp rise in the figures for the total ammonia of the sterilised sea-water and one per cent. sewage being much greater than the small corresponding rise in one per cent. solution of sewage and natural unsterilised sea-water. And although the figure for the total ammonias was not so high as in the case of the laboratory solutions when it was three and four times the original quantity, nevertheless the striking inference could be drawn that after sterilising the sea-water, the effect of the salts in solution

was very similar to that of the laboratory solutions. It appeared as though by sterilising the sea-water we had removed the chief cause of the difference in behaviour between the laboratory solutions incubated with 1 per cent. of sewage and sea-water similarly treated. Whether this was partly due to the removal of living organisms and partly to a breakdown in the complex compounds in solution brought about by the increased temperature and pressure, is a subject for future work.

General Results.

So far as they go, the experiments gave the following general results:—

1. A solution of sodium chloride seemed at first to favour the production of free and albuminoid ammonia from sewage up to a certain point only, but the process went no further, and neither nitrates nor nitrites appeared.

2. The relatively much smaller percentages of $MgSO_4$ and $MgCl_2$ present in sea-water did not appear to influence the breakdown of the sewage differently from the high percentage of NaCl, either in the production of the two ammonias or the non-production of nitrates or nitrites.

3. A mixture of the above salts in solution in their respective relative percentages seemed to influence a greater production of free and albuminoid ammonia from sewage than any single salt in solution. The effect, however, was not an additive one. And again, there was no production of nitrates or nitrites.

4. The effect of sterilised sea-water upon the appearance of the two ammonias from sewage closely resembled the laboratory solutions of the three salts. It is suggested that the salts in solution may act as disintegrating forces upon the organic matter in sewage only up to a certain point. There was no production of nitrates and nitrites.

5. Sea-water in its natural unsterilised condition did not act on sewage in the development of the two ammonias in the same way as the sterilised sea-water or the artificial laboratory solutions of three chief saline constituents. The total amount of the free and albuminoid ammonias produced in unsterilised sea-water was very small compared with that produced by solutions of the salts contained in sea-water, or by the sterilised sea-water. They agree in the fact that there was no production of nitrates and nitrites.

6. One of the most striking effects of (*a*) the salts in solution, both singly and when mixed in the proportions in which they occur in sea-water, and also of (*b*) the natural sea-water, both sterilised and unsterilised, was in the interference in the production of nitrates and nitrites.

These experiments seem to show that, as we have before stated, within the limits of the experimental method employed there was no production of nitrates. In most systems of sewage disposal, the production of nitrates and the disappearance of the two ammonias are considered to be measures of their efficiency: and it is never difficult to estimate the nitrates in such processes. Now, these experiments showed that at no stage of the incubation of 1 per cent. solutions of unfiltered sewage with sea-water, extending over a period of eight weeks, was there any production of nitrates within the limits of the experimental method before described. It seemed that the decomposition of the sewage did not extend to a complete breakdown into the simple forms of carbon dioxide, water, and nitrates, but that highly complex nitrogenous compounds were still held in solution, which might or might not undergo further decomposition or absorption by the flora and fauna of the sea. We have earlier pointed out the important fact of the small quantity of nitrogen as nitrate found by Thorp and Morton in an analysis of the Irish Sea, and our experiments explain this non-appearance of nitrates.

7. Finally, we consider that the experiments suggest a practical bearing on the disposal of sewage. They seem to prove that to pour sewage directly into the sea or an estuary is essentially unsound. The intolerable smell produced appears to be due to an incomplete and slow oxidation of the various organic compounds in the sewage. The dissolved salts may interfere with the growth of the useful nitrifying organisms, which would normally and rapidly convert the material into non-odorous and neutral substances such as nitrates. The result is that the substances only slowly decompose, and the various compounds produced cause at times an intolerable nuisance. We think, therefore, that the experiments indicate that if sewage is to be poured into the sea or an estuary near any town or city, it should first be treated by some filtration or bacterial or other process, so that the compounds which cause poisonous and evil smells may be rapidly and efficiently destroyed.

The investigation will be continued, and particularly as to the fate of the nitrifying organisms.

NOTES FROM THE REPORTS OF THE MEDICAL OFFICERS OF HEALTH.

Extract from the Report of the Medical Officer of Health for the County Borough of Huddersfield for 1904,
S. G. MOORE, M.D., D.P.H.

TYPHOID FEVER FROM POLLUTED WATER.

The danger of drinking water from surface wells is well shown by an examination of the circumstances leading to a sharp outbreak of typhoid fever among the workpeople at a mill in the Lindley district.

Out of 350 workpeople in the mill, 11 were notified to be suffering from typhoid fever between the 25th August and 15th September, a period of 22 days. Of these, 9 worked in departments where the temperature was high and the work was laborious. The total number working in that department amounted to 184, so that out of 350 workpeople in all, 184 furnished 9 out of the 11 cases, and the remaining 166 only furnished 2. But the whole 11 were known to have partaken of the water of a particular well. They did so because it was cooler than the public supply, which was known to be safe, and which was also available filtered, two modern high-pressure filters being fitted in places convenient of access for the workpeople.

The total number of cases of typhoid fever in the whole Borough during August was 10. Of these 6 belonged to the above series. The number for September was 16, and 5 of these belonged to the above series. The relative incidence per 10,000 of the population for August is:—

	August.	September.
Huddersfield	1·05	1·69
Lindley	11·23	9·36

From the above figures it will be seen that in Lindley in August the incidence per 10,000 persons was nearly 11 times as large as in the whole Borough, and during September nearly 6 times as great.

The foregoing facts show beyond doubt that the water of the well in question was the cause of the outbreak, and this is amply corroborated by a consideration of the circumstances in relation to the position of the well and the surface drainage of the area in which it is situated. An analysis of the water showed pollution.

The wells were closed as soon as the facts became known, without authority from the Committee, which was obtained later.

NOTES ON LEGISLATION AND LAW CASES.

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ADULTERATION.—*Analysis—Deterioration of Sample—Analysis by Commissioners of Inland Revenue at request of Vendor—Impossibility—Condition precedent to Conviction—Sale of Food and Drugs Acts, 1875 (38 & 39 Vict., c. 63), ss. 9, 14, 21; 1899 (62 & 63 Vict., c. 51), s. 21.*

On the hearing of a complaint charging the appellant with selling milk in an altered condition contrary to s. 9 of the Sale of Food and Drugs Act, 1875, it having been proved by the analysis of the public analyst (who was not required by the appellant to be called as a witness) that the milk was deficient in butter fat, the appellant required that the sample of the milk, which had been retained by the purchaser in accordance with s. 14 of the Act, should be produced and sent to the Commissioners of Inland Revenue for analysis under s. 21 of the Sale of Food and Drugs Act, 1899. The sample, which had been placed in a bottle, was produced, but the cork of the bottle having become loose, the sample was in consequence in such a condition as to make a satisfactory analysis impossible. The appellant was convicted:—

Held, that it was not a condition precedent to a conviction that the retained sample should have been analysed; but that in order to support the conviction there must be a finding of fact by the magistrate that the sample had been sealed or fastened up in such manner as its nature would permit, as provided by s. 14 of the Act of 1875, and the case was therefore remitted to the magistrate.

Hutchison v. *Stevenson*, (1902) 4 F., J.C., 69 distinguished.

SUCKLING *v.* PARKER. Div. Ct. 527.

MEAT.—*Unsound—Information by Sanitary Inspector—Necessity for Authority—Right of private person to prosecute—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 47, sub-s. 2; s. 107, sub-s. 3; s. 123.*

The respondent, a sanitary inspector of a borough council, entered the premises of the appellant, a butcher, and seized certain meat, which was then taken before a magistrate and by him condemned as unsound, and ordered to be destroyed. On the same day a summons was issued on an information laid by the respondent, under s. 47, sub-s. 2, of the Public Health (London) Act, 1891,

charging the appellant with having the meat in his possession for the purpose of sale. Both the information and the summons stated that the respondent was acting on behalf of the borough council, but he had not been expressly authorised by the council to take proceedings against the appellant. The appellant was convicted.

Held, affirming the conviction, that a private person can prosecute for an offence under s. 47, sub-s. 2, and that the absence of authority on the part of the respondent did not invalidate the proceedings, the words "on behalf of" the borough council in the information and summons being mere surplusage.

Allman v. *Hardcastle* (1903), 2 L., G.R., 13 followed.

GIEBLER *v.* MANNING. [1906.] Div. Ct., Vol. I., K.B., 709.

PAVING.—*Passage not being a thoroughfare—Requirement of Owner to pave a second time with different material—Metropolis Management Act, 1855 (18 & 19 Vict. c. 120) ss., 99, 100.*

The owner of a court, passage, or public place, not being a thoroughfare, who has once in obedience to a notice in that behalf under s. 100 of the Metropolis Management Act, 1855, paved or covered the same to the satisfaction of the vestry, cannot be called upon a second time to pave or cover it with a different material, all he can be required to do is to repair the existing pavement or covering.

HARRISON v. OWNER OF NEW STREET MEWS. [1906.] Div. Ct., Vol. I., K.B., 703.

Volume XXVII. No. 9. Issued October, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONGRESS AT BRISTOL.

SECTION II.—ENGINEERING AND ARCHITECTURE.

ADDRESS

By EDWIN T. HALL, V-P.R.I.B.A.

President of the Section.

(FELLOW.)

MY first duty as President of the Section of Engineering and Architecture is to bid you all a hearty welcome to this, the twenty-third Congress, and to express the hope, in which I am sure I have your hearty sympathy, that this meeting of delegates from all parts of the kingdom may succeed in what we all have at heart, furthering the cause of sanitation, in promoting the health and consequently the happiness of mankind in general.

The programme of the papers which will be submitted to you in the various sections, is a comprehensive one dealing with all phases of activity in the department of Hygiene. In our own section I feel that I cannot with advantage address you on such subjects as sewage treatment and disposal, on questions of water supply, of irrigation, of river purification or pollution, nor can I deal with the chemical, medical, and bacteriological problems with which these are intimately connected; but I may, perhaps, venture to address to you some practical remarks on the best way of utilizing, in our buildings, sunlight and air, the two best aids in the restoration of the sick to health, and in the prevention of disease.

In architecture light and air exercise a potent influence, not only on exterior design, but on the planning of buildings. The intense heat of the sun and its brilliant light justified the peristyle and porticoed buildings

of ancient Greece and Rome with their small windows, and the wide structural verandahs of the remoter East, but in the colder and darker North, and particularly in our sea-girt isle, artificial obstruction to the sun's rays has to be avoided, and large windows become a necessity for comfort and for the sanitary occupation of buildings.

This occupation is sometimes lost sight of, and it may be pardoned if I lay stress on the necessity of designing all kinds of buildings from within rather than from without. In other words to take care that the exterior, so far as fenestration is concerned, shall express and grow out of the internal requirements of the building. To sacrifice the interior in order to get an external effect is insincerity in Architecture. It means inconvenience to those who use the building, and results in insanitary conditions prejudicial to body and mind. Appropriateness in design is the correct aim in art, and this arises where the design is the natural and ordered outcome of the purpose for which the building is intended.

In the dwelling-house of the wealthy and middle class this principle of design is not so frequently overlooked, but it is not uncommon in towns, both in these and in poorer dwellings, to see the neglect of such simple rules as that windows should be so disposed that all parts of a room shall be well illuminated, not only because light is the great germ killer, but because it serves to point out impurities otherwise unnoticed; that the tops of windows shall be as near to the ceiling as possible, and that windows should be made to open wide, so that all parts of the room may be scoured by currents of fresh air.

Through ventilation of rooms and of buildings is again of great importance to prevent the accumulation of vitiated air in any part. We must see that other provision than that of open windows is made for the entrance of fresh air and for the exit of foul air. To this end we should provide inlet ventilators of a simple type, and outlets into upcast flues. In theatres and factories where large numbers of people are assembled the constant passage of fresh air through the enclosed space and the removal of foul air, vitiated by the capillary and respiratory emanations as well as by gas, are of the greatest importance. How frequently are consumptive patients improved in health by treatment under hygienic conditions, only to relapse when they return to the insanitary conditions of their normal employment in some factory where these conditions are neglected, where, as was shown in the report of Dr. Scott Haldane, F.R.S. and Mr. E. H. Osborn, C.E., to the Home Office in 1902, the carbon dioxide is sometimes so excessive as to be a source of grave danger to the healthiest persons.

But I have also noted that light and air dominate the planning of buildings, and particularly the block planning of large buildings where health is of primary importance, such as hospitals and schools.

The old-fashioned type of hospital, with which we are familiar, the square building around an enclosed area, is the survival of a very old type of plan, which had its origin in a remote past, in the necessity for defence of life or of privacy; a type carried on in mediæval times, surviving in the courtyard of many an old hostelry.

It possessed the one advantage of concentration, but concentration has its limitations. The old hospital, consisting of a heaped-up block of many storeys, was concentration beyond reason, reduced to a logical but insanitary imperfection. This type in the spread of the science of hygiene has given place to the open plan, to the principle of open air circulation everywhere, of sunlight to all external walls and windows, of open prospect for the inmates themselves.

This open plan type brings me to the mention of Sanatoria, which for many years have been erected in large and ever-increasing numbers all over the civilized world. Here in England they have been in recent years developing in number and usefulness. They are not merely the temporary abodes of consumptive patients, as hospitals for recovery from diseases; they are great colleges of hygiene. Not the drug but the personal influence and disciplinary instruction of the medical staff are the great instruments for removing the ravages of the disease and for rehabilitating the weakened fibre, both physical and mental. But to enable that influence and instruction to be given the architect must make the sanatorium a model, an object lesson of what a sanitary building should be. Hence it is that he should lay out his scheme on broad lines, and design so as to give to all rooms a maximum of sunlight, direct and reflected, so that floor, walls, and ceilings may be illuminated, and while the windows face the sun, he must give ample openings in the inner walls that air may freely pass through, that even when there is no wind the difference of temperature on the hot sunny side may induce currents from the cooler side. There must be no blind corridors ending in blank walls, but all must be well aërated and illuminated by sunlight. The assembly and dining rooms must also be designed on similar lines, and no reservoir for stagnant air should be tolerated. Again, however large the building a sense of security from fire must be felt by all patients, however nervous; hence means for escape from fire must be carefully considered and be in evidence. Everywhere facilities for cleanliness must be evident —cleanliness of the habitation and of the person. I endeavoured to give

effect to all these views in the Frimley Sanitorium for the Brompton Consumption Hospital opened two years ago by H.R.H. the Prince of Wales, and since then two other sanatoria of the same number of beds have been opened, that for the North London Hospital and the King's Sanatorium at Midhurst, recently opened by his Majesty.

A residence in such a school of hygiene cannot but have its influence on all, rich and poor alike; and they will all go forth to preach and talk of what they saw and learned and of the results to those who lived under such conditions. But it will be said all cannot go to such places. True; but all can be and are influenced by those who are so privileged. Even in cities, in the hospitals and infirmaries, similar conditions and similar educational advantages may be obtained. Wards and flat roofs may be designed and utilised for the treatment of consumptives. At Camberwell Infirmary we made the experiment of such design and utilisation, and the medical superintendent, Dr. Keats, informs me that the results are most gratifying and will bear comparison with those in sanatoria.

I cannot but think that the public guardians of the health of the poor in towns might with great advantage follow this precedent, and so bring home to the denizens of crowded towns the same lessons which are taught in country sanatoria. I suggest that our large hospitals under private management might have some parts of their noble institutions especially fitted up for this particular method of treatment, and become schools of hygiene in a very special sense.

In another way—if I may venture to make a suggestion to our medical friends—good may be done. I have heard medical experts complain that little good results to consumptive patients from the out-patient department; but could not short addresses be regularly given to groups of such patients in one of the consulting rooms on fixed days, telling the people what to do in their own homes to ensure hygienic conditions, to impress on them the simple rules of dust removal, of the advantage of opening windows, of letting in light, of abolishing germ-housing stuff curtains, of wiping down walls, and similar simple truths?

At a recent discussion at The Royal Sanitary Institute in London Dr. Shrubsall made some wise and simple suggestions which all can adopt. One was that the housewife should be taught to avoid the broom for cleaning a carpet or other floor covering, and to substitute for it a damp cloth, to be repeatedly rinsed as the dirt is taken off. This simple device avoids the clouds of dust, which not only irritate the throat but settle again on the pictures or ledges of a room. We all know that dirt taken from walls inhabited by tuberculous patients has been proved to

contain bacilli in large numbers, and the removal of such a danger alone would be a great step towards arresting the spread of infection. This homely teaching in the out-patients' department would be of great help to the teaching of hygiene in schools. The two would act and react to the advantage of both. And this brings me to the point of urging that the ventilation of schools should be done by the natural system of open windows and of warming fresh air brought directly into the class-room. I have more than once urged, and now repeat, that I think the plenum system of ventilating class-rooms in schools is bad from the educational point of view. Children are keen observers, and if they are taught in schoolrooms where they see windows are never opened, they will not, owing to their limited intelligence, enquire into the scientific apparatus which renders this opening impossible, but they will go home and grow up to think that windows ought not to be opened, and they will tell their parents so. Thus all the teaching of sanatoria, all the teaching about open windows and fresh air will be counteracted and annulled by the object-lessons of the school.

In the planning of schools I think a word of caution is also needed. It has been a practice of the last twenty years to design a school with a large central assembly hall in which all the pupils can meet, and from this hall the class-rooms are made to open. This arrangement is convenient for assembling and dismissing the scholars, but, assuming that the site is so limited as to render a central hall desirable, it should be separated entirely from the side class-rooms by well ventilated and naturally aërated corridors parallel to the sides of the hall, so that the air of the large hall, vitiated by the emanations of a large number of children, shall not, as it otherwise does, pass directly into the side rooms. Now, I have said I think plenum ventilation in class-rooms is bad from the educational point of view; but I do not say the same for the large assembly-hall placed in the centre of a school. In such a hall, where hundreds of people are assembled (children generally, but adults on special occasions), the volume of fresh air required is so great that an artificial or forced system of air-supply is almost a necessity. Here the object-lesson does not prejudicially affect the child.

In such a hall the assembled people give off aqueous vapour, equivalent to eight gallons of water per thousand people, and their respired breath, germ-laden perhaps, adds a considerable percentage of carbon-dioxide to the normal atmosphere. If infection unfortunately enters in the large hall then the case is still stronger. The ventilated corridor will prevent this impure air and the dust consequent on the movement of a large number of people from passing into the class-rooms.

But where the site is adequate it is better to isolate the assembly-hall, as has been done in one of our largest modern schools—the Blue-coat school at Horsham, and this, be it noted, is the old system of planning in all the colleges of our great universities, and in our public schools.

The class-rooms should then be in another building or buildings, and on one side only of a corridor, which itself should have ample windows. This is the plan practically universally adopted in our sanatoria at home and abroad. What our medical and architectural experts think best for sanatoria may be taken as a standard for school class-rooms so far as hygienic conditions are concerned.

In treating of pure air our thoughts naturally turn to one of its greatest enemies, viz., the smoke-laden atmosphere of large towns.

The Royal Sanitary Institute has always taken an active part in the crusade against this nuisance, and recently held a Conference and Exhibition on Smoke Abatement.

In the rapid growth of our manufactures during the past half-century, mechanical power became a prime necessity. To efficiently obtain this by the only practicable means then known, steam generation, large plants of boilers fed by coal became universal, and the atmosphere of manufacturing towns became palls of smoke, destructive to any natural beauty of site or of environs, to the architecture of our buildings, and very injurious to health. The aggregation of houses for the teeming population attracted to the factories, increased the evil because the houses were and are generally heated by open fires in badly-designed grates, each one contributing its quota of unconsumed coal smoke to the atmosphere. Now I am not so unpractical as to run a tilt against the open fireplace for sitting-rooms; on the contrary, I am an advocate for such fireplaces. They are the most cheerful means of warming rooms in a residence, and *per se* the best exhaust ventilator that can be had. I cannot, however, think that even in the house fireplace or flue, science is impotent to invent some simple apparatus to arrest and utilise the whole of the fuel used, and save those products of combustion which now go to waste. The overhanging firebrick back to the grate is a great improvement in this direction, but it is not the last word.

I would here call attention to the report on recent tests of open domestic grates which was published in *The Lancet* of May 19. A study of this may lead to further improvements of great value.

But the kitchen fire-range, the great smoke producer, might be done away with and a gas kitchener substituted, or perhaps later on an electric apparatus.

Here I wish to give a word of warning about gas stoves without flues being used in rooms. It may interest you to know that as recently as May of this year Dr. Rideal carried out four tests on several different patterns of these flueless gas stoves, the results of which conclusively justify the objection to the use of this type of stove. Not only was the raising of temperature relatively small, but the volume of carbonic acid gas found in the atmosphere of the room during the test of four hours was raised from about 5 to an average of 49 per 10,000, and that although there was a register open in the fireplace of the room.

In factories, however, I hope the coal furnace and tall chimney (usually hideous) may in the relatively near future be done away with. Electricity would effect a perfect revolution in the atmospheric conditions. The clouds of smoke would disappear; the sun would once more rule the day. Our buildings would stand out bright, their decay would be arrested, and the whole aspect of our towns would be changed. With this change, and consequent on it, would the health of the mass of the people be improved.

The improvement would not only be outside our buildings, but inside. The network of main and counter-shafts, with miles of belting whirling about the dust in the workshops, now used to run the machinery, would all disappear, because each machine could be run by its attached motor. Anyone who has seen a factory fitted up on these lines will know the great difference of appearance and of comfort it presents in contrast with the older type.

In public buildings, like hotels and similar institutions, and in large boarding schools, we can, however, all do our share towards smoke abatement. In bedrooms, for example, fireplaces for coal consumption should be done away with, and hot-water pipes and radiators substituted, with, of course, good ventilation. I have adopted this system in all the nurses' houses of my recent hospitals, and its advantages are obvious. For example, take a building with, say, 250 bedrooms. With the ordinary fireplace only used occasionally, the room is usually very cold in the winter, and the flue (frequently soot- or dust-coated) becomes an inlet for cold and dirt-laden air. It is commonly the only aperture for air currents when, as is often the case, the window is closed.

With the other system, the hot-water radiator or circulation-pipe keeps the temperature normal to that of the rest of the building. An inlet ventilator admits fresh air to the radiator and thence to the room, and the exhaust ventilation (assisted by an electric fan, if need be) insures the constant passage of air. The atmospheric effect externally

is that there are 250 smoke ejectors the less in the town. The large kitchen, again, to cook for, say, 800 or 1,000 people, under the old coal-fire system was a perfect smoke factory. Now, particularly in the south, in large institutions and hotels, no coal is used for cooking, and consequently no smoke defiles the atmosphere.

Passing from this subject, there has been a good deal said and written lately as to rural by-laws and their effect on housing the poor. The fact is we in England are slow to move, and when we do move we too frequently go to extremes.

In the general consideration of better house construction it was legitimate to bear carefully in mind the danger from fire in cities and towns, and to insist on using materials that were fire-resisting; and the Local Government Board did a great service in preparing model by-laws, so as to insure some uniformity throughout our urban districts. On the creation of rural sanitary authorities the question of sanitary building construction came up of necessity for consideration, and frequently, for want of knowledge, it was assumed that the local board could not do better than adopt (sometimes with practically no modification) the model by-laws. These, however, were never intended as hard and fast rules applicable everywhere, but as models on which local authorities might work as a text. In the result, rules that were reasonable in towns were unreasonably adopted and insisted on in hamlets, and the cost of housing the poor was greatly increased. It is reasonable to insist (and as sanitarians we should insist) on damp-courses in the walls, on preventing ground-air from passing into rooms, on sound drainage and its ventilation, and on preventing water pollution; but beyond these essentials a great many of the present requirements for cottages are not only unnecessary, but are deterrent of building, and so the agricultural labourer is driven away for lack of residences.

In the recent exhibition of cottages at Letchworth there was nothing very new in design or illuminating in construction, but such exhibitions are stimulating.

From housing the workman to housing those who are past work is a natural transition, and I should like to say a few words on what is a national question.

This is no place for discussing politics, but the unemployed and unemployable are with us, and we must take care that we do not let legitimate sentiment for unavoidable and temporary distress obscure our vision and lead us into the fatal mistake of pauperising large masses of people. The subject is no new one, but has been before our forefathers

for centuries, and the legislature has attempted again and again to grapple with it, notably since the reign of Queen Elizabeth.

From various causes there have always been large numbers of idle people; some from no fault of their own, many from choice. We are apt to think it a modern result of the vast increase of our population, of the advance of civilisation; but the proportion of indigent persons to population is far less now than when England was sparsely populated.

It would take almost a volume to discuss the subject of the relief of the poor, but we are familiar with what are still called workhouses; with infirmaries and asylums. With the last two classes of admirable philanthropic institutions I do not propose to deal, but I should like to throw out for consideration the possibility of an improvement in the principle and type of workhouses. Would it not be possible to grade our homes for the indigent classes? At present the worthy aged poor who have done their honest life's work, and those who from lack of employment are temporarily indigent, are associated with the thriftless, the idle, and the otherwise unemployable. Could we not separate these three classes? Instead of one large workhouse to contain all, could we not have a home for the worthy aged poor, another for the temporarily unemployed, and a third for the other class? The last to be a real workhouse, whose inmates should be under discipline, compelled to work, taught to work and to earn their living where they lack the knowledge, and all made to learn that they have a duty to the community as imperative as that of the community to them. As they learn their duty and become employable they should be entitled, when necessity arises, to claim the right to reception into the higher grade home for the unemployed; and if misfortune should fall on them in their old age, should know that they will be ultimately received into the highest grade home for the worthy aged.

It will, of course, be asked, "Will not work so done compete with that done by wage-earners outside?" But I think if their work were confined to supplying the needs of the three classes of homes it would be a fair and reasonable employment.

Now, as architects we can assist the authorities in the design of such buildings as are suitable to these classes, each one differing in its characteristics from the others. Attempts have been made to classify inmates of present poorhouses. I suggest the classification of the houses themselves.

In the field of building construction the use of steel is now general, and will probably become more and more so, and, for a reason that will be presently touched on, its modern application affects the salubrity of our

cities. The practice of a skeleton of stanchions and girders riveted and bolted together to carry all the weight, merely clothing these with brick and stone, is a type of building now commonly seen. The San Francisco fire has demonstrated one great advantage of this form of structure. This consists in the fact that all parts are of one metal, tied and bound together; whereas in a building with walls of stone or brick, relying for their stability principally on specific gravity and gravitation, and only held together by an earthy material of comparatively small tensile strength, carrying horizontal supports of other materials, there is manifestly less cohesion, and any disturbance of the foundations will produce greater damage or destruction of the fabric than in the other structure. Reinforced concrete is the latest evolution of steel used in combination with cement and concrete. Its strength has been demonstrated; but I feel that one danger lurks in it, and that is the effect of fire and water on it. Slight piers of the material are used for very large loads, and should a fire play directly on these piers the cement will, I fear, crack, letting in moist air or water, which will oxidize the steel and destroy it. I have heard of reservoirs constructed of the material where this result has happened, and the rust has burst the concrete. In reinforced concrete the strength lies in the perfect combination and cohesion of two materials. If this be interfered with, collapse must follow, for neither the steel nor the concrete alone is of adequate strength to support the load easily carried by their combined strength.

Steel-framed construction has evolved the skyscraper of twenty or more storeys, and, however interesting this may be as a feat of engineering and permissible in isolated cases, its general adoption as a means of expansion of floor area, would be an unmitigated evil in our streets, shutting out all sunlight and creating deep channels for wind currents. Already the overcrowding arising from unreasonable concentration has produced great evils and taught its lessons.

In the broader aspect of sanitation we have to consider the laying out of our towns and cities. With electricity and other auto-motor means of transport we may spread ourselves out, give more air-space about our buildings, leave open squares, gardens, and parks as oases in the desert of buildings, to the advantage of all, to the brightening of our lives and the refining of our tastes; to the broadening of our ideas and to the stimulating of our creative faculties.

The benefits of such an expansion to the appearance of our large towns are hardly calculable, but the greatest of these would be in the incentive it would give to local patriotism, to creating a pride in one's environment,

because it is something of which to be proud. No one who visits Paris or Vienna can fail to feel the breadth and stateliness of the open spaces and boulevards, and the same sentiment is awakened at Edinburgh. When our black country towns become white, and the enlightened policy of our modern municipal councils has cut wide and noble thoroughfares through what were the dens and alleys of their cities, we shall be able to point with pride to these great centres not only of wealth but of taste, stateliness, and culture.

In conclusion, may we also press on the public at large to take care that new buildings shall be worthy of our towns and cities; that there shall be a real desire to get good architecture to adorn their streets. The Royal Institute of British Architects has been earnestly striving for many years to raise the standard of the practitioners of our art by enforcing thorough training, by making the examinations for young architects sound tests of knowledge, but many men (particularly in the provinces) evade these and hold aloof from our organisation on the ground that it is useless for them to toil, because the incompetent man, unequipped by study and having no claim to the title of Architect which he assumes, receives the employment which his local friends secure for him without inquiry as to whether the representative body of architects have given him their diploma or not. May we hope that the Institute's efforts will receive the cordial support of all public-minded men, because then we may be sure the standard of architectural art in the public mind will be raised, and competent men alone will be commissioned to see to the adornment of the great centres of industry, of liberty, and of throbbing life, which are the glory of our country.

ISOLATED HOMES FOR THE AGED POOR *v.* THE WORKHOUSE.

A. SAXON SNELL, F.R.I.B.A.

(FELLOW.)

WHEN honoured by your Committee with an invitation to open the discussion upon this subject, I accepted with pleasure because it is one that has interested me for many years as an architect and as a citizen. But when it became necessary to evolve definite suggestions from abstract principles, difficulties commenced; for one is in some danger of importing into the discussion matters which are subjects of political or social controversy. That is a contingency we should avoid, if we are to give unbiassed consideration to the purely practical and economic side of the question, which is, I take it, what we are here to discuss.

Nevertheless, it is impossible to deal with it at all without some reference to the causes which have led boards of guardians to consider a different method of housing the aged poor under their charge and care.

There can be no doubt that in framing the Act of 1834, the legislature made the condition of *destitution* (not mere *poverty*) slightly penal; and human nature being what it was, is, and always will be, we cannot complain.

The establishment of workhouses was an outcome of this Commission; the first workhouse in this country was built in this very city. I am not sure, but I think it exists even to this day at Eastville.

Ever since, and especially during the last decade, the growing spirit of altruism has moved us to mitigate the harshness and anomalies of the system; and few of us can withhold at least sympathetic consideration of the several remedies proposed. Such sympathy, however, may easily land us on the slippery slope of mere sentiment, with all its blindness to the radical defects and weaknesses of human nature.

The Commission of 1895 was the outcome of this spirit, but it was unable to recommend any drastic alteration in the law, which indeed has been softened much in administration.

With well-constructed buildings and abundance of good food, mere physical destitution is amply relieved in the workhouse, but these do little

for mental and moral conditions. It is unfortunately true that the atmosphere of the workhouse is far from elevating. Whatever shreds of self-respect are left on entering, slowly and surely die out, leaving the individual no more than an interest in his daily meals. There are several causes for this, but it has long been felt that one of the most potent is enforced companionship with the worst elements of the congregation. Another is the monotony of existence; and a third is deprivation of liberty and of the opportunity to have some share (though it be but as a spectator) in the life of the community. Some time ago an aged pauper from a London workhouse fell dead in the street whilst wheeling a hand-cart for delivering firewood from the workhouse. At the inquest one of the jury expressed his opinion that it was a great "hardship" that an old man should have been put to such a task. "Hardship!" exclaimed the witness (the master of the workhouse), "it is considered a privilege." "Then," replied the juryman, "God preserve me from a life in which wheeling a barrow becomes a privilege."

These matters are acknowledged by the Commission of 1895, but little more than classification was recommended, and any idea of promoting what may be called the "almshouse" idea was scouted.

Classification goes a long way to meet the first of these causes. Segregation of the better elements of workhouse society from the worse has been carried out to a considerable extent in all large workhouses; but only the more glaring evils of the system have been mitigated. Still more classification is wanted, besides other reforms, and no doubt the labours of the Royal Commission now sitting will result in much re-organisation.

I assume that we are considering the case only of the best class of aged poor; those, in fact, who have drifted to the workhouse by the force of circumstances beyond their control. I may add that this particular class bears but a very small proportion to the whole; none the less it is entitled to all the consideration we can give it.

On the other hand, better conditions for the lower stratum of our labouring population, and what is of greater importance, a higher sentiment of filial responsibility, may reduce the proportion materially.

Provided greater stringency is exercised in the case of the unworthy majority, better treatment of the minority will not have those fatal effects of undermining individual efforts to be self-supporting, which are freely prophesied for any relaxation of the severity of the Poor Law.

What is required besides collective segregation for this particular class is the opportunity of enjoying the comparative privacy to which they have been accustomed, the denial of which is hardship to them.

I have seen many workhouses, old and new, and have often thought that the inmates were less out of place in the old than in the new. A short time ago I was shown over part of a workhouse in South London for more or less infirm people, and of which the board of guardians are justly proud. Nothing more could be done in the way of creature comforts. But the inmates appeared as lay figures, as having nothing in common with their surroundings. Some of the men were playing bagatelle in a desultory manner, but most of them sat round the walls and tables doing nothing. In their own homes most of them would have been engaged upon some task in which they took interest. The women were more or less employed in light needlework, etc., but they, too, were oppressed with the "institution" air. Even the beautifully kept and comfortable rooms for the married couples lacked that indefinite air of home, of which one ingredient is, I am bound to say, a certain amount of untidiness.

Classification in the workhouse cannot be carried further than it is at Fulham; special privileges are given there to the best class of aged poor, and every effort is made by the provision of light employment, etc., to give them an interest in life. But their surroundings still suggest the workhouse rather than the home: a character which is reduced to a minimum in the case of the married couples' cottages, with their pretty front gardens and plain but homely fittings, to which is added the personal note of the occupants.

It is, then, for this class that isolated or cottage homes are proposed and, in some few cases, have been erected, and there can be no question as to their being an improvement upon associated wards, except for those who are too old and feeble to attend to their daily wants without assistance. For such, we have always provided bright and comfortable infirm wards, where they are nursed or cared for by an attendant. They can be, and generally are, treated better, than in their own homes. When they are really ill there is the infirmary.

The Select Committee on the Cottage Homes Bill of 1899 was "impressed with the advantages of providing separate cottages in connection with the workhouse," but its recommendation does not express wholehearted approval, and it embraces married couples' quarters, which have been provided in most workhouses for twenty years and upwards.

After all, the cottage home is a modified reversion to the principle of the almshouse, which took shape some centuries ago, and lasts till this day.

The question we have to ask is, can these cottage homes be built, maintained, and administered at a reasonable cost, a cost per inmate not exceeding that which obtains in a workhouse? There are no data of the

cost of administration to go upon, as yet; but I think that it is possible: indeed, that the cost may be less, for reasons which will be given later on.

As far as I am aware the system has been adopted by two Unions only, Sheffield and Bradford, and by the courtesy of the architects, Messrs. Empsall and Clarkson, I give the plans of the Bradford buildings. Other unions or parishes have adopted the principle of cubicles for the sleeping accommodation. The system at Wandsworth is but a half-way house to the more comprehensive scheme at Bradford.

The accommodation provided is for 132 beds, and the cost of the buildings without land and furnishing, fencing and laying out gronnd, but including administrative buildings, is estimated at £100 per bed.

The scheme is very interesting, and it is a long step in the right direction. It is barely in working order yet, and it is impossible, therefore, to say whether the experiment will effect all that is hoped.

To illustrate the special features recommended I have prepared a rough scheme for a home for 48 healthy aged men. It might be increased to 100 or more without proportionate increase of the administrative block or of officers in charge.

The main items in the cost of maintaining the indoor poor are rent, including interest and redemption of capital or building loans; administration charges, including salaries of officials; maintenance, including food, clothing, fuel, etc.

Superficially considered, it seems impossible to doubt that under all these heads the cost of isolated homes must be greater than that of associated ward-blocks; but that is because the same standards are used for both. My purpose is to shew that the charges under the first head may be less, and to suggest that under the second they may certainly be less, and under the third not appreciably more.

In the first place the buildings, being of one storey only, require lighter construction. They entail no long passages or staircases, both expensively constructed to resist fire.

In modern workhouses an elaborate system of pipes and boilers is required to provide lavatories and baths with hot and cold water, and the wards with hot pipes or radiators, besides electric light and steam cooking. I am far from suggesting that these things are unnecessary. The difficulty of organising for common labour the population of a workhouse, the great majority of whom have neither the will to work nor the ability to work properly, necessitates a small army of officers and servants.

In the second place, as the homes would house the *élite* of the workhouse inmates, the amount of supervision required would be reduced to a

minimum. If residence in the homes were made contingent upon good behaviour, there would be a strong inducement to act accordingly, and a strong incentive to good behaviour for those still in the workhouse, with a view of qualifying for entrance to the homes.

Admission might be made contingent upon good behaviour and the necessary strength to enable each man to look after himself. Under a system of small associated cottages the second condition might be relaxed somewhat, if one of the small family was able to give assistance to the weaker member.

With respect to the number, single tenements are not desirable as a rule. Sudden illness or a small accident might leave an old man without aid at a critical moment. Two in each tenement are better, though I have heard that there are objections. On the whole, three to four in a room is the best number. An experienced officer would soon know the different types who would make congenial housemates; and indeed, no doubt in time the inmates themselves would have something to say in the matter.

Referring to my rough scheme and taking the type of cottage A, which appears to me best adapted to the purpose, and allowing three in each room or tenement, or twelve in each cottage, four of them would accommodate 48 old men.

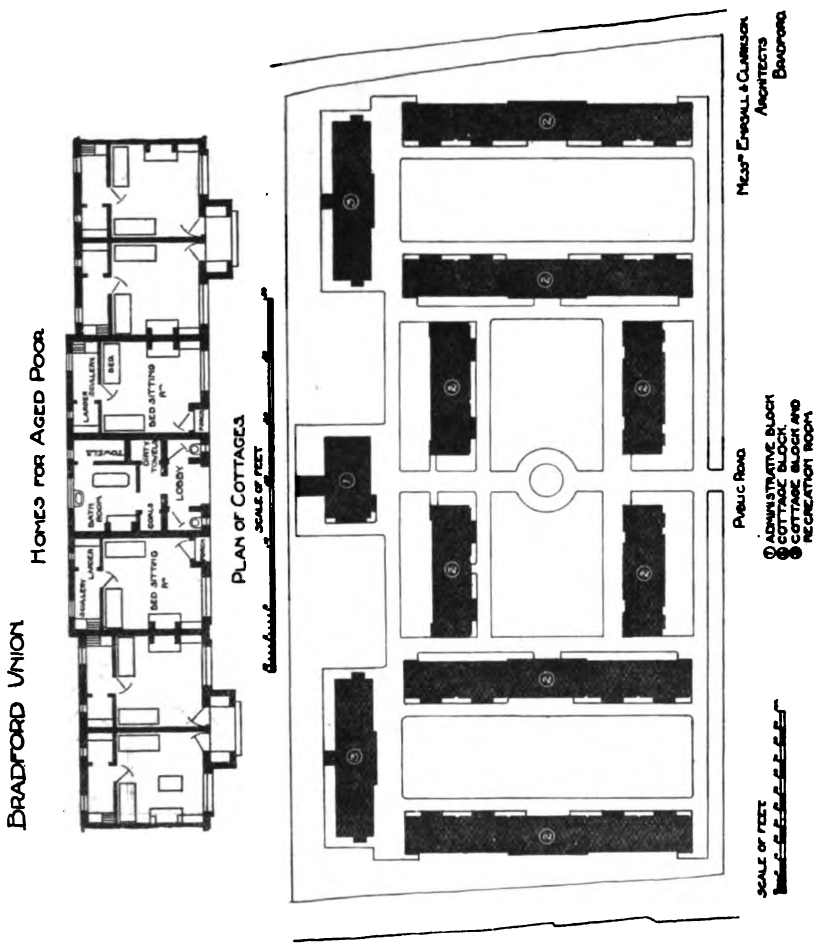
Each tenement comprises a sitting room, the bed cubicles being curtained off during the day. To each is attached a small scullery and food cupboard. There is a small porch with a seat in it, and this forms an inglenook by the fireplace which would be very cosy. The sanitary conveniences would be grouped together and screened off by trees, etc. Each room has a fireplace with a small range and oven which would be used by the inmates in preparing breakfast and tea. No hot water would be laid on either to the sink or lavatory basin. The kettle would have to be brought into requisition for such a luxury, which, by the way, is denied to the vast majority of those who live outside the workhouse.

Other types, B and C, are a little smaller, simpler, and cheaper.

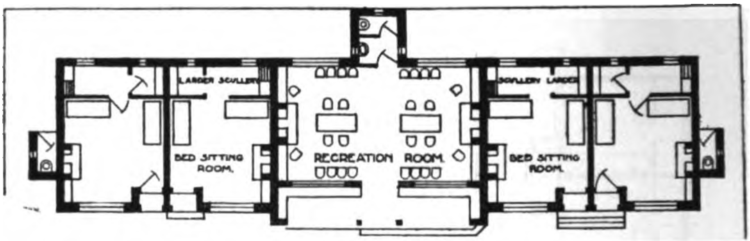
I also show the plans of some small blocks for married couples, which, with few modifications, would be suitable as cottage homes for either sex.

Those for Wandsworth Union were designed by Mr. Cecil Sharp, A.R.I.B.A., who tells me that the cost, exclusive of furnishing, was £3,640, or about £75 per inmate. As these blocks (and the others illustrated) form part of a large workhouse, no administrative offices are included in the cost.

The buildings at Marylebone and Mitcham Workhouses were designed


BRADFORD UNION
HOMES FOR AGED POOR
PLAN OF COTTAGES
SCALE OF FEET
BATH ROOM
LOBBY
COALS
LARDER
SCULLERY
BED SITTING R^M
MESSRS EMPSALL & CLARKSON
ARCHITECTS
BRADFORD
PUBLIC ROAD
1 ADMINISTRATIVE BLOCK
2 COTTAGE BLOCK
3 COTTAGE BLOCK AND RECREATION ROOM
SCALE OF FEET

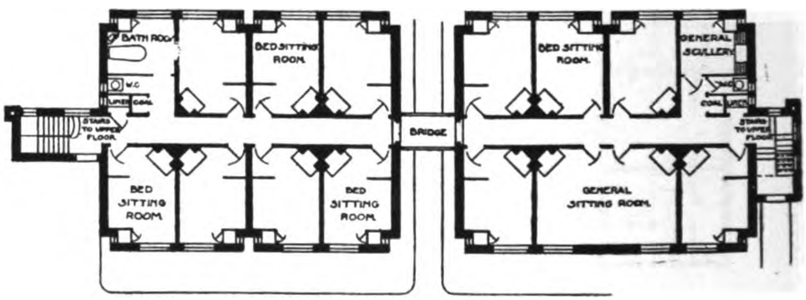
Bradford Union Cottage Homes.



Cottage Block with Recreation Room

Wandsworth Union Married Couples Quarters.

(Cecil A. Sharp Esq Architect.)



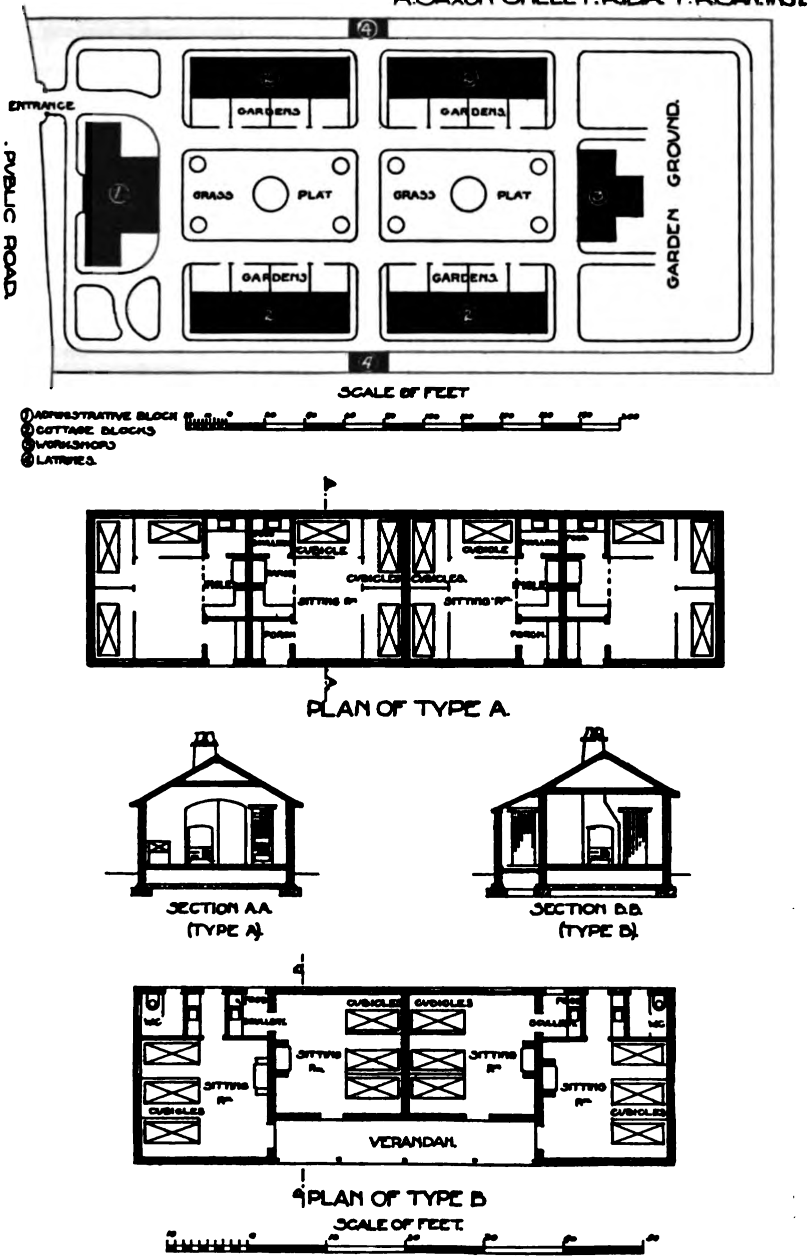
Ground Floor Plan

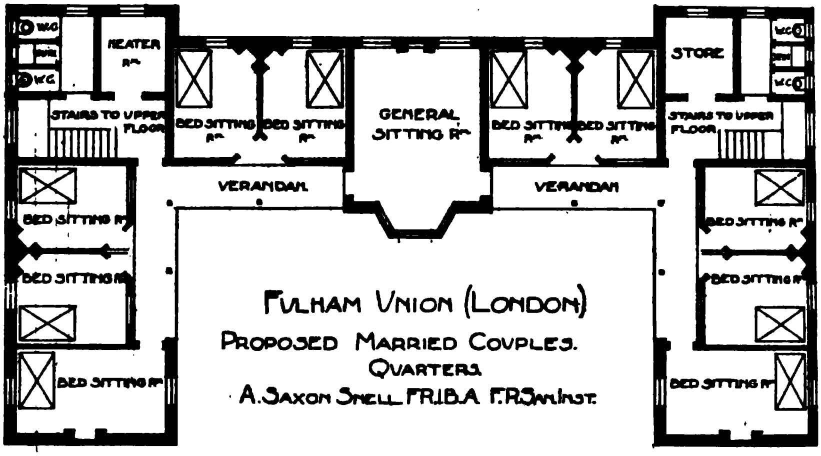
(First Floor Similar)

Scale of Feet

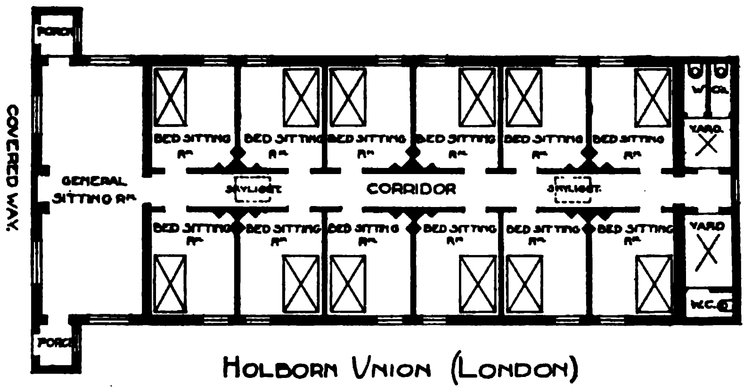
MODEL HOMES FOR AGED POOR.

A. SAXON SNELL F.R.I.B.A. F.R.SAN.INST.

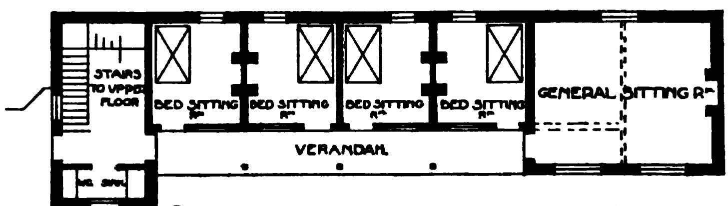




Fulham Union (London)
Proposed Married Couples. Quarters.
A. Saxon Snell. F.R.I.B.A. F.R.San.Inst.



Holborn Union (London)
Married Couples. Quarters.
H. Saxon Snell. F.R.I.B.A. F.San.Inst.



St Marylebone Parish (London)
Married Couples Quarters.
H. Saxon Snell. F.R.I.B.A. F.San.Inst.

Scale of Feet

by the late Mr. Henry Saxon Snell, and have been built and occupied for nearly twenty years. The block designed by myself for Fulham Parish has not yet been carried out.

Every detail should be simplified, the object being to approximate the accommodation and conveniences as far as possible to those to which the majority of the inmates have been accustomed in their own homes. They might add anything in the way of decoration in their own way and with such works of art as might come into their possession in illustrated papers. The taste displayed might be poor, but it would be their own.

The administrative block (or cottage) should also be designed upon the most economical lines, and without unnecessary rooms. For instance, a general meeting or recreation room should be provided for the inmates. Why should it not also be used as a dining-hall? If a committee room is required, why not use it also as a library or quiet room for the inmates? There is no need to build a separate house for the matron, a bed and sitting-room are all that is necessary.

About three baths would be required, and should be in the administrative cottage. No chapel is required, the inmates being allowed to attend any church or chapel in the neighbourhood.

The buildings might be surrounded by a wooden fence (stone if cheaper), the grounds laid out partly in flower beds, partly in vegetable beds, and every encouragement given to the inmates to keep the place beautiful by their own labour, under the superintendence of a gardener.

The cost of these cottages, worked out on the basis of sixpence per foot, amounts to £3,160, or £44 per inmate. The administrative blocks, drainage, fencing, etc., would bring it up to £60–70 per inmate.

The officer in charge should be a matron, preferably a trained nurse, whose ministrations would be of great service to the old and feeble, and whose disciplined habits would be invaluable in keeping everything in good order. She would require two or three servants for cooking and the care of the administrative buildings. A superintending gardener, and probably a carpenter or handyman, would also be required.

In connection with the estimate, I would remind you that in almshouses few officers are employed. In that with which I am best acquainted, the Printers' Almshouses at Wood Green, North London, there are thirty-two cottages accommodating fifty-six persons (of whom the majority are married couples). It is managed, under a visiting committee, by one trained nurse, assisted by a warden who is one of the pensioners. A gardener is also employed, but does not spend his whole time there.

Might not such an establishment be the means of mitigating much, if

not all the degradation of the workhouse? Would it not encourage a greater interest in the inmates of the more fortunate classes outside?

MISS CONSTANCE COCHRANE (Rural Housing and Sanitation Association) referred to the great scarcity of cottages in rural districts. The tied houses attached to farms were wanted for labourers who could work; so the aged poor were turned out the moment they ceased to work, and there was no place for them but the workhouse.

MR. P. HARDING ROBERTS (Holywell) considered that the provision of isolated homes for the aged poor in the workhouses was not the best method of dealing with that class of paupers. If they were deserving poor he maintained that sufficient outdoor relief should be given to make them comfortable in their own homes, rather than to remove them to workhouses or publicly-provided cottages. It was possible to deal with and classify paupers who ought to be in workhouses without incurring the heavy expenditure proposed by the writer of the paper. He had had twenty years' experience of workhouse administration, and in that time he only knew of one case in which a married couple wished to live together.

THE UTILIZATION OF OLD PITS AND QUARRIES, AND OF CLIFFS, FOR THE RECEPTION OF RUBBISH.

By HORACE B. WOODWARD, F.R.S.

IT will be readily admitted that in many parts of the British Islands local authorities do not exercise proper control over the disposal of the waste products of the communities. While this is notably the case in many rural districts, there are semi-rural districts, and even popular sea-side resorts, where sanitary reforms are likewise necessary.

Since the time of the Roman occupation, as we learn from Mr. F. W. Allen's interesting paper on Leicester,* it has been a custom to utilize abandoned pits for the reception of town-refuse.

The evils likely to result from the process, when dwelling houses are afterwards erected on the tracts, have been sufficiently recognised, and the law now exercises its protective influence.

The pollution of building sites is not, however, the only objection that should be raised to the indiscriminate infilling of pits and quarries. In many parts of the country picturesque heaths and commons, places that may be regarded as natural health resorts, have been defiled by the shooting of rubbish into old gravel or clay pits or stone quarries. Moreover, the material, glass and crockery, sharp fragments of metal, as well as dust and decomposing organic matter, is apt to be scattered on ground bordering the abandoned pits. From an æsthetic point of view this is deplorable; but the rubbish is not only unsightly, it is unwholesome from the ill odours that arise, and dangerous from the wounds that may be inflicted especially on children.

As a matter of fact the number of abandoned excavations has largely increased during the last twenty years, because the poorer kinds of road-metal are no longer used to the extent that was formerly the case; while numbers of brickyards have been relinquished because larger works, in better situations, have monopolised the trade. As many of these excavations have been utilized for the reception of town or trade refuse, it is not surprising that the geologist often finds his task less pleasant than it

* On the collection, disposal and utilization of Town Refuse in Leicester. *Jour. R. San. Inst.*, Vol. xxv. 1904, p. 1.

might be. Indeed, to make observations in a kind of dust-bin is in itself an insanitary proceeding.

The benefit of the community has of course to come before individualism, and with this ideal before him, the geologist is naturally concerned at the way in which water-bearing strata are rendered liable to contamination, from the practice of shooting parish refuse into old chalk-pits, limestone-quarries, or gravel-pits. When the local supply of drinking water is drawn from shallow wells in the adjacent strata, the danger of pollution may be serious.

In many places around our sea-coasts, cliffs have been appropriated for the tipping of rubbish; and this not only in remote regions. Thus two years ago the inhabitants of a well-known health resort on the south coast were considering the question of shooting the rubbish over the cliffs on the eastern side of the town. At present the little river is polluted and disfigured near its outlet by vegetable and other refuse cast into it by inhabitants along its banks; and this material, cabbage-stalks, egg-shells, and what not, is distributed over the very limited beach at low tide.

In another locality, in North Wales, the cliff was utilised for town-refuse in proximity to a residential quarter, and to a frequented portion of the shore.

Far away in North Britain, a cliff-face bordering the rocky harbour, is the town dust-bin. The materials that are not blown over the town or washed into the water, remain banked up against the cliff, offensive enough in hot weather. The lighter materials that enter the water are floated up the harbour and are stranded on the beach in front of the principal houses. There sea-weed and old boots, paper, wood and dead animals get commingled in a tangled mass, that is at intervals removed by boat and transferred to a distant part of the bay.

In connection with this subject it is satisfactory to learn that public latrines have been provided at certain fishing-villages; * but there is still a lamentable pollution of the foreshore in many a picturesque locality adjacent to fishing and other villages.

It is evident that the elementary principles of sanitation, cleanliness and tidiness, might be taught more forcibly in schools, and carried into practice more generally by local authorities. As remarked by Mr. W. F. Goodrich, the tipping of refuse is a relic of antiquity, "There is only one method of final disposition for the whole of the waste, that is the great purifier—fire."†

* Report by Dr. J. Spencer Low to Local Government Board, No. 200, 1904.

† "The Economic Disposal of Town Refuse," 1901, p. 19.

With regard to this method of disposal of town- and village-refuse, the cost of destructors is doubtless prohibitive for small communities. If it is at present needful to utilise pits for refuse, care should be taken in their selection. The local water-bearing strata, as well as prominent pictorial and frequented grounds, whether commons or cliffs, should be avoided; and pits where necessary, should be dug as far as possible from public thoroughfares.

Co-operation may eventually solve some of the difficulties. Dr. Sims Woodhead last year remarked that "the selfishness of communities must be counteracted by the constitution of some central organisation, which shall be empowered to control water supplies, and which shall also be empowered to prevent contamination of any possible supply with sewage,"* or, it may be added, with any other refuse material.

Dr. Woodhead expressed his opinion in favour of a "National Water Board with County Committees," a proposal somewhat akin to that advocated at a public congress summoned by the Society of Arts in 1878, the need of which becomes each year more urgent.

MR. W. WHITAKER (Croydon) corroborated Mr. Woodward's statements as to the disposal of refuse. He had lately seen a small chalk-pit in a residential district close to London, which was being used for the collection of old sardine-tins, slop-pails, and other like articles. Other cases of a much worse kind had come before him several years ago and had been duly recorded.

MR. WOODWARD (London), in reply to a question from the President, remarked that with regard to the selection of sites suitable for the shooting of rubbish, any information in the possession of the Geological Survey was always at the public service. He remarked that Stroud was in advance of some other places. One of the by-laws of the Rural District Council was as follows:—"A person shall not place, or cause or suffer to be placed, any filth, dust, ashes, or rubbish removed from any drain, earth-closet, privy, ashpit, or cesspool, or other receptacle, in any lissen, cleft, joint, fissure or parting in the Great Oolite or other rocks."

THE PRESIDENT moved that this meeting do recommend the subject to the attention of the Council of The Royal Sanitary Institute, transmitting to them a copy of the by-law, with the view to their making a representation to the Government in order to get the general adoption of some such by-law throughout the United Kingdom.

The resolution was put and carried.

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* *Jour. R. San. Inst.*, Vol. xxvi., 1905, pp. 426, 427.

NOTES ON THE BACTERIAL TREATMENT OF SEWAGE.

By STUART H. DAVIES.

ABSTRACT.

THE Author points out a growing tendency towards uniformity of opinion in some important directions, and indicates modifications in methods of working which seem to be demanded.

The points to which particular attention is drawn are (*a*) Residence in tanks, as a means of equalizing sewage, or as preparation for further treatment; (*b*) sludge reduction; (*c*) arrestment of suspended or irreducible matters.

(*a*) Prolonged residence in tanks is not generally necessary, either as arising from variation in the character of sewage or as productive of a change facilitating treatment in beds.

(*b*) While opinions as to the possible amount of sludge reduction have not been realised, such matter may be rendered inoffensive by the action of organisms under aerobic or anaerobic conditions.

(*c*) Beds must be effectually protected by the more complete removal of matters in suspension in the initial stages of treatment.

The great variety usually associated with sewage, together with the tendency which such variation may have in lessening bacterial efficiency are points which have been frequently insisted upon, but the success of attempts at purification in cases in which variation in character has been ignored or but little considered compel attention, as the results appear to show that failure has more frequently arisen from variation in flow than from variation in the nature of the liquid treated; and if we except towns where the sewage is frequently characterised by a strongly acid reaction, and bacterial life and development is of necessity small, so that equalisation or neutralisation *must* be resorted to, probably the question of large tank accommodation (with a view to equalising the sewage or as productive of a necessary change) will receive decreasing attention. In ordinary cases the organisms upon which we rely have shown themselves sufficiently elastic in their powers of adjustment and digestion, to deal with variations common to sewage. A purification of from 80 to 90 per cent. was effected in a few minutes on dissolved impurities at Leeds. The best effluents obtained on the works were those

from a Ducat bed, and good effluents were also assured by the triple filtration of more or less crude sewage.

Septic tanks have proved of great practical value in the finer division of suspended matter as discharged on to beds, and the better maintenance of capacity as contrasted with a process of simple sedimentation.

Sludge reduction may be materially aided by certain conditions. Concentration, temperature, and the provision of surfaces influence the result.

As to the more effectual arrestment of suspended matter, simpler and less costly means of attainment than those suggested appear necessary.

It appears necessary to keep the following aims in view:—(*a*) collection and concentration of sludge without undue interruptions to the flow of sewage; (*b*) more effectual arrestment of suspended matters and avoidance of clogging by improved methods of working rather than by elaboration in design; (*c*) resolution of sludge under an aerobic condition as productive of less offence and more rapid treatment.

For rapidity of treatment, the value of trickling-beds is evident; by this system a working capacity may be maintained for a considerable period, which may apparently be prolonged by systematic drying and washing out, as evinced by matter removed from beds of this character after resting. It is doubtful if the full value of surfaces in this respect can be realised apart from a period of stagnation; and despite the fact that contact-beds and trickling-filters have in the past been regarded somewhat in the light of rival methods of treatment, an approach towards a system of combined action seems possible. The difficulty of arresting matter which may cause clogging, in sedimentation or septic tanks, arising either from the weight of such matter, increased velocity, or evolution of gases, appears to point to an arrangement whereby suspended matter is arrested and resolved by a system of contact, leaving impurities in solution to be dealt with by a continuous flow; but in any system of contact preliminary to continuous treatment, the beds must be filled with a medium which can be readily washed, and provision must be made for the careful drawing off of the effluent by floating arms or telescopic weirs, and for the ample aeration of the beds.

To avoid unnecessary interruption to the flow of sewage, and to insure the more complete resolution of arrested matter, it seems desirable to curtail the period of contact as far as possible, and to prolong that of rest. This seems to be justified by the facts that the purity of an effluent resulting from a system of contact (in freedom from suspended matter) is largely effected during early residence; while the period of maximum activity in the destruction of solid organic matter in a contact-bed is that following on the drawing off of the liquid.

Under such a system deposited matter will probably show a lessened tendency to adhere to the medium in the beds owing to increased aeration, and the process of washing out will be facilitated. The indestructability of the medium, the careful drawing off of the effluent, and facilities for washing out during times of storm, would become of importance.

Analyses of sludge taken from beds have frequently shown that matter has been carried forward (by accelerated flow and by the activity taking place in tanks) which should have been deposited, and removed from grit chambers.

Variation in flow is objectionable in connection with detritus tanks designed to retain the maximum amount of inorganic matter and the minimum amount of organic, and departure from a rate of flow which will secure this object must result in the release of insoluble matters with consequent loss of water capacity in tanks or beds, or the deposition of reducible matters which should be dealt with later.

Rules in the design of detritus tanks (such as a flow of 40 feet per minute irrespective of length of flow, or a capacity of 2 gallons per head irrespective of the form of tank) are of little value. A uniform rate of flow under varying discharges can be attained by adaptation of the form of tank. A tank to fulfil this purpose would be wide and shallow, and would need a stepped weir at the outlet-end, but the height of flow would afford an indication of the quantity of sewage to be dealt with on beds, the greatest possible head would at all times be available, and while the cost of construction and labour in cleaning must be greater than in some forms of tank, the advantages gained would justify it, the ill-effects of imperfect design in this particular being felt more or less throughout the process of treatment.

In large tanks the author suggests the possibility of emptying from below, screw-down valves being placed at intervals in the floor.

[*For Discussion on this Paper, see page 486.*]

THE LIFE-HISTORY FOR EIGHT YEARS OF THE EXPERIMENTAL COKE AND CLINKER FILTER-BEDS AT KINGSTON-ON-THAMES.

By DOUGLAS ARCHIBALD, M.A.

(MEMBER.)

THE establishment and record of results with these beds form a somewhat unique chapter in sewage disposal, on account, not merely of the exceptional character of the chemical treatment and purification in the Kingston tanks, but because at the present time the coke-bed, after eight years continuous working, with scarcely a single day's rest, and with no alteration or cleansing, except on one occasion, is now receiving and dealing with no less than 8 fillings a day of the Kingston tank effluent (at the special request of the Royal Commission) and is giving an average purification thereon of about 62·4 per cent., from an average of 16 daily averages, as reckoned by the analyses of albuminoid ammonia.

THE ESTABLISHMENT OF EXPERIMENTAL COKE AND CLINKER FILTER-BEDS.

The Native Guano Company, for whose system of precipitation the works was designed, were able to satisfy all the requirements of the Thames Conservancy with the unfiltered tank effluent from 1888 to 1896, when the Conservancy demanded a stricter standard all the way up the river. On knowing this the Company at once determined to erect experimental contact beds to supplement the tanks, one of coke-breeze and the other of clinker.

A brief account of the results from the prolonged working of these beds may show what can be done by single filtration of a high-class chemical effluent, from which all the suspended and a large proportion of the dissolved solids have been eliminated in the tanks.

The Material Dimensions of the Coke and Clinker Beds.

Table I.

	Coke-bed.	Clinker-bed.
Dimensions—		
Length	20 feet	20 feet.
Breadth	11 feet	11 feet.
Depth	3 feet	3 feet.
Material—		
Bottom, 9 inches ...	Unbroken coke, 4 ins. to 6 ins.	Large clinker, 4 ins. to 6 ins.
Second, 9 inches ...	Broken coke, 1 in. to 2 ins. ...	Clinker, 1 in. to ¼ in.
Top, 18 inches ...	Breeze, with dust removed, ⅜ in. to ¼ in.	

The empty capacity would thus be 4,125 gallons.

As will be seen later the water capacity of the coke-bed was abnormally small, probably owing to some obliquity in its construction, in comparison with its areal dimensions.

The water capacity of the clinker-bed was normal.

Filling of the Experimental Coke and Clinker Beds.

The filling and emptying of these beds has been based upon two hours actual contact, and as much aëration as was possible, consistent with the number of fills per 24 hours.

This is very similar to the plan by which the Roscoe beds at Manchester were worked.

With 6 fills the times have been thus:—

Start filling ...	6 a.m.	Begin to run off ...	8.15 a.m.
Full	6.15 „	Stand empty until	9 „

and so on until the evening, when the bed was run off at 8.15 p.m. and stood empty until 12 midnight, and again was run off at 2.20 a.m. and stood empty until 6 a.m.

I have not been personally responsible for the arrangement of the times of contact and aëration, otherwise I should have been inclined to try the effect of shortening the period of contact and lengthening the period of aëration. At the same time the highly satisfactory purification that has been effected shews that the empirical time-table is a good one. It is, however, very important that the facilities for emptying a filter-bed constructed similar to these on a large scale should be equally good, otherwiset he lowest stratum of the bed would never get aërated and might conceivably become a breeding ground for anaërobes, which might undo some of the work done in upper parts of the bed and reproduce the odours and unstable compounds connected with the hydration instead of the oxidation stage of metamorphosis.

TABLE II.

KINGSTON-ON-THAMES SEWAGE WORKS. NATIVE GUANO CO.'S TANK PROCESS.

Results of Seven years and four months' Contact Filtration (Single Contact) through the Company's Experimental Coke Breeze Filter.

ALBUMINOID AMMONIA. PARTS PER MILLION (DAILY MEANS).

Dimensions of Filter, 24·4 sq. yds. by 1 yd. depth. Empty capacity in gallons taken as 4,125.

No.	Period.	No. of Fills in 24 hours.	Days.	No. of Samples Analysed.	Gallons per cube yard.	Daily Mean. Tank Effluent. Albuminoid Ammonia. Parts per million.			Corresponding Purifications on Daily Mean Tank Effluent in successive periods.	
						Average.	Max.	Min.	Max. Tank. cent.	Min. Tank. Per cent.
1.	May 24th, 1898, to Sept. 18th, 1900 ...	3	848	29	163	2·33	3·69 *F. 0·96	1·24 F. 0·56	74	54
2.	Sept. 19th, 1900, to Jan. 4th, 1901 ...	4	107	57	207	2·25	3·59 F. 0·89	1·05 F. 0·47	75	55
3.	Jan. 5th, 1901, to Oct. 2nd, 1901 ...	6	270	166	337	2·33	3·73 F. 1·25	1·06 F. 0·48	66	54
4.	Oct. 3rd, 1901, to July 24th, 1902 ...	4	204	102	211	2·90	3·75† F. 0·90	1·24 F. 0·60	76	51
5.	July 25th, 1902, to Sept. 17th, 1904 ...	3	724	111	149	2·48	3·80† F. 1·10	1·60 F. 0·60	71	62
6.	Sept. 18th, 1904, to Nov. 28th, 1904 ...	4	71	15	195	2·60	3·10 F. 1·20	2·00 F. 0·76	61	62
7.	Nov. 29th, 1904, to Sept. 18th, 1905 ...	6	294	75	272	2·93	3·40† F. 1·26	1·40 F. 0·72	63	48
	General Means or Totals ...		2,518	555	219 Average.	2·54 Average.			68	55

* F. indicates Corresponding Filtrate.

† There were some higher figures in the Tank Effluents and Filtrates n these Groups, but they were so manifestly due to the abnormal presence of gas refuse that I have omitted them from being legitimate extremes. They are, however, included in the General Averages.

TABLE II.—*Continued.*

Average Daily Mean Filtrate.	Daily Mean. Filtrate Single Contact. Albuminoid Ammonia.		Corresponding Percentage Purifications.				
	Max.	Max.	Average.	Max. Filter.	Min. Filter.	Absolute Max.—I.	Absolute Min.—I.
0·81	1·15	0·56	65	58	54	80	58
	*T. 2·75	T. 1·24				T. 3·60 F. 0·70	T. 1·60 F. 0·66
0·66	1·01	0·33	71	61	77	84	42
	T. 2·59	T. 1·47				T. 2·69 F. 0·49	T. 1·13 F. 0·65
0·88	1·33	0·46	62	57	76	82	44
	T. 3·09	T. 1·90				T. 2·48 F. 0·44	T. 1·99 F. 1·11
0·95	1·30†	0·60	67	46	51	76	46
	T. 2·40	T. 1·24				T. 3·75 F. 0·90	T. 1·65 F. 0·90
0·94	1·30†	0 60	62	46	62	75	43
	T. 2·40	T. 1·60				T. 3·20 F. 0·80	T. 1·60 F. 0·90
0·93	1·20	0·70	64	61	70	70	54
	T. 3·10	T. 3·00				T. 3·00 F. 0·70	T. 2·40 F. 1·10
0·92	1·40†	0·44	64	50	70	70	50
	T. 2·80	T. 1·50				T. 3·20 F. 0·96	T. 2·80 F. 1·40
0·89 True Average			65	53	65	77	48

* T. indicates Corresponding Tank Effluent.

† There were some higher figures in the Tank Effluents and Filtrates in these Groups, but they were so manifestly due to the abnormal presence of gas refuse that I have omitted them from being legitimate extremes. They are, however, included in the General Averages.

THE COKE-FILTER BED.

Purification, measured by Albuminoid Ammonia.

The general results are given in Table III.

The action of this filter on the tank effluent is one by which not merely the average purification as measured by the albuminoid ammonia is greatly increased, but the range of variability about the mean is reduced both in absolute measure and as a percentage of the mean value.

The following table gives the differences from the averages during the successive periods of the extreme maxima and minima daily mean values of the albuminoid ammonia of the Tank Effluent and Filtrate:—

TABLE III.—*Figures in parts per million.*

	Daily Mean Tank Effluent.		Daily Mean Filtrate.	
Period.	Differences of Extremes from Averages. Albuminoid.	Averages of Periods.	Differences of Extremes from Averages. Albuminoid.	Averages of Periods.
1	+ 1·36 – 1·09	2·33	+ 0·34 – 0·25	0·81
2	+ 1·24 – 1·10	2·25	+ 0·35 – 1·33	0·66
3	+ 1·40 – 1·27	2·33	+ 0·45 – 1·42	0·88
4	+ 0·85 – 1·66	2·90	+ 0·35 – 0·35	0·95
5	+ 1·32 – 0·88	2·48	+ 0·36 – 0·34	0·94
6	+ 0·50 – 0·60	2·60	+ 0·27 – 0·23	0·93
7	+ 0·47 – 1·53	2·93	+ 0·48 – 0·48	0·92
Averages ...	+ 1·07 – 1·16	2·54 (True.)	+ 0·37 – 0·34	0·89 (True.)

From this we may deduce the mean amplitude of variation of the daily mean tank effluent as 2·23 and of the daily mean filtrate as 0·71.

If the index of variability be taken as represented by the ratio-amplitude of range to average we have

$$\text{For the Tank } \frac{2·23}{2·54} \text{ and for the Filtrate } \frac{0·71}{0·89}$$

and thus for the

$$\left.\begin{array}{ll}\text{Daily Mean Tank Effluent} & 0·88 \\ \text{Daily Mean Filtrate} \quad \ldots & 0·79\end{array}\right\} \text{ as the Index of Variability,}$$

and a reasonable expectation that a high albuminoid in the tank effluent will be reduced in a greater proportion than the 65 per cent. given by the average daily means from the tank and filter, viz., 2·54 and 0·89 (albuminoid in parts per million).

An inspection of the figures in Table II. shows that this law is of general incidence.

Thus the purifications corresponding to the maxima (daily mean) tank effluents are usually maxima, and corresponding to the minima (daily mean) tank effluents minima, the reverse law applying generally to the filtrates.

The average differences are, moreover, very similar, thus :—

TABLE IV.

	Daily Mean Tank Effluents.		Daily Mean Filtrates.	
	Maximum. Per cent.	Minimum. Per cent.	Maximum. Per cent.	Minimum. Per cent.
Average tank to filter purifications per cent. in all groups.	68	55	53	65

The lowest purification corresponding to a maximum tank effluent is 61 per cent., and the highest corresponding to a minimum tank effluent 62 per cent. The greatest exceptions to this rule appear to be the following:

Daily Mean Tank Effluent.	Daily Mean Filtrate.	Purification per cent.
2·80	1·40	50 } Maximum filtrates of
2·40	1·30	46 } periods 4 and 7.
1·47	0·33	77 Minimum filtrate.

For practical purposes it is only necessary to consider the maxima filtrates, from which it appears that a daily mean purification of over 50 per cent. can be relied upon for tank effluents above the average figure for albuminoid, and that with the Kingston sewage and tank effluent, and a filter of the relative dimensions, and of material similar to the one used in these experiments with the coke filter-bed, the mean daily albuminoid figure will average 0·89, and very seldom exceed 1·25.

The number of deviations above and below the average have not been counted, but cannot differ largely owing to the approximate equality of the extreme deviations in Table V. The number of negative deviations, however, is probably greater, and more so than might be inferred from the average deviations $+ 0{\cdot}37$ and $- 0{\cdot}34$ owing to the fact that the average 0·89 includes some cases excluded from consideration as extremes owing to abnormal condition in regard to gas refuse.

The general balance may be seen from Table V., where the averages are compared with the arithmetical means of the extreme values. The differences between the values for the calculated averages and those of the arithmetical means of extremes are remarkably small in all the periods. The inference is that the occurrence of the extreme deviations is due to

the operation of a law which operates more or less regularly and equally on both sides of the average and is practically independent of the rate of flow or the age of the filter.

TABLE V.—*Filtrate (Daily Mean).*

Period.	(a) Average.	(b) $\frac{\text{Max.} + \text{Min.}}{2}$	Difference. (a) – (b).
1	0·81	0·85	– 0·04
2	0·66	0·67	– 0·01
3	0·88	0·89	– 0·01
4	0·95	0·95	nil.
5	0·94	0·95	– 0·01
6	0·93	0·95	– 0·02
7	0·92	0·92	nil.

The following cases of extreme values exhibit the same tendency of the filter to generally exercise its maximum purification when most wanted, and its least when least so, and so be somewhat self-adjustive :—

TABLE VI.

Cases.	Tank Effluent.	Filtrate.	Purification. Per cent.
Absolute maximum daily mean purification ...	2·69	0·49	84
Absolute maximum daily mean tank effluent..	3·80	1·10	71
Absolute minimum daily mean purification ...	1·13	0·65	42
Absolute minimum daily mean tank effluent..	1·05	0·47	55

THE COKE FILTER BED.

Purification by Oxygen absorbed in four hours.

The estimations of oxygen absorbed have not been made continuously, since in the South of England more importance is attached to the albuminoid ammonia as an index of impurity. (See Table VII.)

TABLE VII.—*Coke Filter.*

Periods.	No. of Samples.	Daily Mean Average Oxygen absorbed in 4 hours. Grains per Gallon.		Daily Mean Average Purification on Tank Effluent. Per cent.	Daily Mean Average No. of Fills.
		Tank.	Filtrate.		
May 4, 1900 to Sept. 4, 1901	27	1·50	0·45	70	4·7 (258 gallons per cube yard.)
		Max. tank 2·42	0·39	Purification. 83	
		Min. tank. 0·83	0·33	60	

The Purifying Work of the Coke Filter.

The process of the average purification corresponding to the quantity passed through the filter in each of the seven periods may be realised from the following table:—

Table VIII.

Period.	No. of Fills per 24 hours.	Average capacity of Filter in gallons.	Average flow in gallons per cube yard.	Average Purification upon Tank Effluent from Albuminoid.
1	3	1,328	163	65
2	4	1,265	207	71
3	6	1,372	337	62
4	4	1,288	211	67
5	3	1,219	149	62
6	4	1,120	195	64
7	6	1,107	272	64
		Average	219	65

It will be seen that the purification reached a maximum in the second period of four fillings, and altogether averaged higher at this number than at any other. Also that while it fell somewhat at the first trial of six fillings, it maintained a high figure in the seventh period when six fillings were again tried. *Prima facie* this might be partly due to the progressive reduction in the amount passed through owing to the reduction in capacity given in the average flow per cubic yard, but a more rigid analysis shews this hypothesis to be untenable.

In order to give an idea of what may be termed the purification of the filter at each number of fillings, I suggest the following function which combines the flow and purification combined.

The *purification-work* may be defined as *flow per cube yard multiplied by percentage of purification*, and I shall indicate this function by the symbol term "*Flowpur.*"

Thus if 219 represents the average flow for all the periods per cubic yard, and 65 per cent. is the average amount of albuminoid eliminated, or as it is termed the average purification—

$\frac{219 \times 65}{100}$, or 142·35, represents the average "flowpur."

Treating the figures for the successive periods in this way we have the following (Table IX.):—

TABLE IX.

Period.	No. of Fills per 24 hours.	Flowpur.	Time of each Period in days.
1	3	106	848
2	4	147	107
3	6	209	270
4	4	141	204
5	3	92	724
6	4	125	71
7	6	174	294
	Average	142	

Since the "flowpur" of a contact filter bed evidently varies according to the number of actual fills, in order to determine the progressive deterioration, comparison can only be legitimately made between the values for the flowpur at the same number of fills. Taking the various cases, and reckoning from the middle of each period, we have the following:—

TABLE X.

Period.	No. of Fillings.	Percentage Reduction of Flowpur.	No. of days elapsed.	Percentage Reduction per annum.
2 to 6	4	15	1,286	4·25
4 to 6	4	11	861	4·66
2 to 4	4	4	425	3·43
3 to 7	6	17	1,281	4·75

Owing to an alteration made in the top 12 inches of the filter in March, 1901, its capacity was somewhat increased at the commencement of the third period, so that the figures 4·66 and 4·75 are probably the most correct. Taking the mean of these, which correspond very closely, the flowpur of the filter may be said to reduce at a rate of about 4·7 per cent. per annum, the actual practical amount being dependent on the number of fills found to be possible with a required degree of purification.

The actual reduction in the water-capacity of the filter from the third to the seventh period was equal to 19·3 per cent., which works out about 5·5 per cent. per annum. The flowpur, therefore, deteriorates somewhat less than the water-capacity, and therefore the purification-power alone is well maintained. The reductions in both are small.

A similar comparison of contact filters receiving a septic tank effluent will show a deterioration in, or a loss of water capacity amounting to about *six* times as much as the above.

The Clinker Filter Bed.

This has been worked somewhat similarly to the coke-bed, except that latterly the number of fillings has been reduced to four per 24 hours, while those on the coke-bed have been increased to eight.

This has been done at the request of the Royal Commission, because the coke-bed has consistently given better purifications, and in order to see how far the fillings could be increased when dealing with a tank-effluent of this species without materially diminishing the purification.

Prima facie it was conceivable that part of the difference between the degree of purification attained by the coke and the clinker beds might be due to the difference in the two water-capacities corresponding to the same surfaces, but the relation already found between the capacities and the purifications shows that this factor is either insignificant or indeterminate, since when, the average flow per cube yard in the coke-bed is 163 gallons the purification is 65 per cent., and when it is 336 gallons 62 per cent., or a drop of only 3 per cent. for an increase of 174 gallons, while for an increase from 163 gallons flow to 207 gallons flow there is an increase in the purification of 6 per cent.

A detailed comparison of the analyses of the filtrates from the clinker-bed has not been made, but for a period of two years a comparison of 106 samples taken under similar conditions has been made, which is given below:

Table XI.—*Comparison of Coke and Clinker Filter Beds.*

Purifications. Albuminoid Ammonia. (Daily Means.)

Period, September 26, 1902, to September 17, 1904.

No. of Samples.	Average Tank Effluent; parts per million.	Average Filtrate; parts per million.	Purification. Per cent.	Average flow per cube yard.
Coke, 106	2·46	0·95	61	149*
Clinker, 106	2·46	1·25	49	217*
			+ 12	− 68

* Excluding the idea that the difference in the ratio of water-capacities to surfaces could account for any material difference in the purifications.

Now if the law which so evidently operates in the case of the coke-bed holds for the clinker-bed, the purification for a flow of 217 gallons ought to some extent to be *higher* than for one of 149. (See Table VIII.)

Even if we take the most unfavourable view, and consider that the

higher flow accounted partly for the lower purification in the proportion of 3 per cent. for 174 gallons, we should only be able to account for 1 per cent. of the difference in favour of the coke.

It may therefore be safely concluded that the difference shown above has nothing to do with the difference of capacity and flow in the two filters, but is due to physical, chemical, or bacterial differences, or all three combined, in the action of the two filters upon the tank-effluent of the Native Guano Company's process at Kingston-on-Thames, by which the coke-bed exercises a purification of 12 per cent. more than the clinker-bed.

The actual purifying work done by the filters measured in flowpurs during this period was—Coke, 90·89 flowpurs; Clinker, 106·33 flowpurs; but there is little doubt that if the coke-filter were of the same volume and water-capacity as the clinker-filter the differences in the flowpurs would have been the same as in the purifications.

The clinker-filter has never shown in other periods any purifications corresponding to those of the coke-filter. Consequently I have confined myself chiefly to a discussion of the results from the coke-bed.

THE WATER CAPACITY OF THE EXPERIMENTAL COKE AND CLINKER BEDS.

Owing probably to some obliquity in its dimensions, the absolute capacity of the coke-bed has been always considerably less than the normal capacity of such beds from the very first. The water-capacity of the clinker-bed has on the other hand been normal.

Thus the original water-capacity* of various similar beds at Manchester, Leeds, Leicester and London was on the average 49·5 per cent.† of their empty capacity and progressively dropped thence to 28·4 per cent. of the empty capacity after 6·2 months when receiving settled sewage. A mean of 18 beds in various centres given in Dr. Clowes' Report No. 679, yields an average of 45 per cent.

Similarly the Roscoe beds at Manchester almost exactly of the same dimensions as the coke and clinker beds at Kingston, viz., 25 cubic yards, began with a water capacity of 1,750 gallons which is 41 per cent. of the empty capacity.

At Kingston the linear dimensions of both the coke and clinker beds

* The original capacity in the case of London was taken ten days after the experiments began, in Leicester 23 days.

† See my former paper on "A Comparison of Chemical and Septic Tank Systems," *Jour. San. Inst.*, Vol. XXIV., Part III., p. 333.

should have made their empty capacity equal to 24·4 cubic yards or 4,125 gallons. As a fact their original water capacities were as follows:

Water Capacities.	Gallons.	Percentage of empty capacity.
Coke-bed	1,400	34·0
Clinker-bed	1,850	44·7

The cause of this remarkable difference has not yet been ascertained, but as soon as the present experiments cease, the material will be cleared out, and the empty capacities re-measured.

The value for the clinker-bed is normal.

In estimating the relative loss of capacity little error will be introduced; and the rate appears to be almost identical for either filter (Table XII.)

TABLE XII.—*Reduction in Water-capacity of the Coke and Clinker Beds.*

Coke bed. Year.	Capacity. Gallons.	Clinker bed. Year.	Gallons.
1901, March	1,420	1902, July 7	1,850
1901, October	1,324	1903, October 17	1,700
1903, October	1,129	1904, November 11	1,690
1904, November 9	1,190	1905, December 1	1,355
1905, November 9	990	1906, February 22	1,346
1906, February 22	817		

These give a total average decline in capacity per annum, as follows:

				Annual percentage reduction in capacity.
Coke-bed	...	...	...	8·5
Clinker-bed	...	...	...	8·0

A similar comparison of the alterations of capacity of the Roscoe beds at Manchester shows a decline of capacity amounting to 10·7 per cent. per annum of original water-capacity as follows:—

			Water capacity in gallons.
Dec. 19, 1905	...	...	1,750
Jan. 8, 1899	...	...	1,188

These may be taken to represent the rate of loss of capacity of coke-beds after a good chemical effluent has been passed on, the small loss being evidently connected with the small amount of suspended matter.

This may be readily seen by a comparison in which the effect of the so-called chemical effluent at Barking is shown, in the rate of loss of capacity of the one-acre 6 ft. coke-bed. This effluent contains about 8

TABLE XIII.

Period.	Locality.	Rate of Loss of Capacity per cent. per week.	Tank Process, and Chemicals in grains per gallon.	Average Percentage Purification on Tank Effluents.	No. of Fills.	Gallons per Cubic yard.
March, 1901, to February, 1906	Kingston ... ... 3 ft. coke.	0·16	Chemical 35	64	5	233
December, 1895, to January, 1899 ...	Manchester (Roscoe Beds)... 3 ft. coke.	0·21	Chemical 12	49·6	3	157
May, 1898, to April, 1900	London... ... ... 6 ft. coke bed.	0·54	Chemical 4	80	1⅓rd	53
September, 1898, to September, 1900 ...	Leicester ... ... 4 ft. 6 in.	0·80	No Chemicals.	51	3	195 (About)

Apart from the rapid deterioration of the beds where the chemicals are sparingly used, and the consequent expense involved in cleansing or renewal, the general comparative efficiency of the above systems may be compared, first by the Filtration flowpurs for one contact, and secondly by the total Purifications up to single contact, the number of cubic yards of filter bed for effecting such purification per million gallons, and the total flowpurs from the crude sewage.

grains of suspended matter per gallon, and the stoppage of such matter by the filter probably accounts for the high purification at an expense of capacity of the bed (Table XIII.).

TABLE XIV.—*Flowpurs per Single Contact.*

System.	Flowpurs.*
Kingston ... ... Chemical tank and single contact.	149
Manchester ... ... Chemical tank and Roscoe beds.	77
London ... ... Chemical tank and 6 ft. bed.	42
Leicester ... ... Detritus tank and first contact.	99

TABLE XV.

Total Purification per cent.		Cube yards of Filter bed for 1 million gallons daily flow.†	Total Flowpurs.*
Kingston	91	4,291	212
Manchester	80	6,369	125
London	85	18,800	45
Leicester	75	5,129	140

* In these flowpurs only the purification in albuminoid ammonia has been considered.
† In estimating the ultimate amount of filter bed required, regard must be paid to the rate of loss of capacity per week (Table XIII.).

[*This Discussion applies also to the Paper by* MR. STUART H. DAVIES *on page 470.*]

DR. S. RIDEAL (London) agreed with the author in the desirability of limiting the size of the detritus tank, and keeping the sewage in agitation when passing through it. He would like the whole flow to be passed through such tanks, as storm filter beds were even at the best of little use, and were still less of value when choked with detritus.

MR. A. J. MARTIN (London) said that there was one point with which he was in cordial agreement, the necessity for freeing the effluent from suspended solids before filtration; but it was not merely the suspended solids which they had to guard against, as with a clear effluent there would often be considerable clogging of the filtering material by growths fed by the matter dissolved in the effluent. Hence the desirability of providing some sort of rough filter, containing material which might be washed, on which such growths might form, instead of on the material of the filter proper. An hour's flow seemed to him

far too large for a detritus chamber. He found from ten to twenty minutes sufficient for all legitimate detritus; any larger capacity led to the deposition of organic solids. Dr. Rideal had said that the pioneers of the septic tank *now* made provision for the removal of the undigested residuum. They had done so from the start. He congratulated Mr. Archibald on the good work he was getting out of his contact beds. Mr. Archibald had been anticipated in respect of his "flow purification" figure by Mr. Watson of Birmingham. He (Mr. Martin) was not sure that the percentage purification was the best measure of the quantity of work done. It would hardly be fair to take it in comparing a weak sewage with a strong one, for which purpose it was necessary to state not the *percentage*, but the *quantity* of impurity removed. It occurred to him that a still better criterion would be the weight of nitrogen oxidised per cubic yard of filtering material. He agreed with Mr. Archibald that it was not fair to treat the published figures from different works as a measure of relative efficiencies. It would not be fair to do so even on Mr. Archibald's flow purification basis, as the higher figure obtained in one case might be due, not to any actual superiority in the system used, but to the fact that the one sewage was more amenable to treatment than the other. Really comparable figures could only be obtained where the systems to be compared were tried on the same sewage under the same control, as was now being done by the Royal Commission on Sewage Disposal. Complaint was made that the Commissioners were taking a long time about their work; but it would be very poor policy to goad them into issuing a premature report on incomplete or ill-digested experiments.

MR. STUART H. DAVIES (London), in reply to a point raised, remarked that he was not an advocate for a system of contact as generally understood, but recent knowledge had revealed the fact that in dealing with certain classes of sewage the presence of potential suspended matter (only partially oxidizable) had to be considered, and while in a larger number of cases the judicious working of continuous filters might prove sufficient to meet all requirements, evidence would seem to show that in other cases matter of the character described would be released with the effluent, and that in order to preserve capacity, and at the same time discharge effluents which would *maintain* the requisite degree of purity, a preliminary period of stagnation in the presence of surfaces might have to be resorted to. The alternative being the final treatment of effluents from trickling filters (in these special cases) by straining through sand, together with the drying and washing out of the filters. The system of contact suggested was not that commonly understood by the term, but was one which involved short periods of contact and long periods of rest, the object being to arrest the matter described, affording opportunities for the oxidation of such proportion as might be amenable to such action and facilities for the easy removal of the remainder.

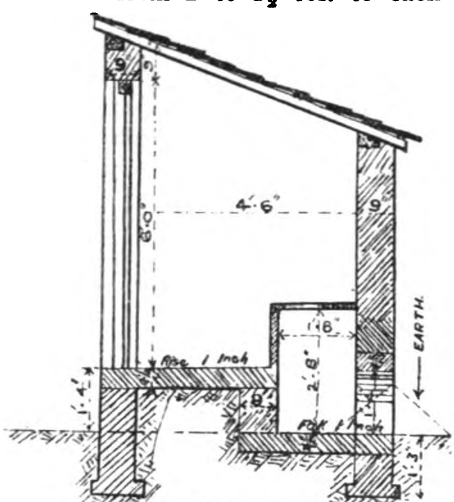
A FORM OF DRY PRIVY SUITABLE FOR SITUATIONS NOT ADAPTED FOR WATER-CLOSETS.

By A. WHARTON METCALFE.

ABSTRACT.

THE Richardson system is not so generally known as it ought to be; it is the invention of the late Mr. Charles Richardson, M.Inst.C.E., F.G.S., the "Father" of the Severn Tunnel.

The conditions for a successful dry closet system are the absence of any depression in which fluid can accumulate and sewage be produced, and a supply of dry sifted earth, which exercises a complete disintegrating action on fæcal matters and paper; so much so, that if supplied in quantities of from 1 to 1½ lbs. to each stool, a compost is formed after a time (two or three weeks) which is completely deodorised, and can be handled and used over again or used as manure, for which purpose it is valuable.



— SECTION —

The best earths are brick earths, loamy surface soils, dried clay, vegetable mould.

In the Richardson dry privy the first condition, the absence of a cesspit, is insured by making the catch above ground level, with a slight gradient towards the back, terminating in a heap of dry earth, shown in dotted line in the figure.

In the annexed sketch the minimum size is shown as used for a cottage. It is designed here as a separate building, but may be constructed equally well as a lean-to.

This type of closet can be conveniently arranged in series, back to back, with an approach alley between for inspection, removing compost, or supplying fresh earth; it is particularly suitable for temporary use in contractors' works, camps, etc., or for schools where water supply is a difficulty. The author erected a series for a village school in the Isle of Man, which were found very convenient and satisfactory.

RURAL WATER SUPPLIES.

By EDWARD F. WILLOUGHBY, M.D.Lond., D.P.H.

THE Public Health (Water) Act, 1878, Sec. 3, reads: "It shall be the duty of every rural sanitary authority to see that every occupied dwelling house within their district has within a *reasonable distance* an available supply of wholesome water *sufficient* for the consumption and use for *domestic purposes of the* inmates of the *house.* If the supply be insufficient and the owner neglect to make provision the local authority, if it be proved to their satisfaction that such supply can be provided to each house at the cost of a capital sum, the interest on which at 5 per cent. would not exceed 2d. per week, or in special cases to be approved by the Local Government Board of 3d., *i.e.* of £8 13s. 4d. or £13, as the case may be, *may* after two notices, and after at least seven months from the date of the first, provide it themselves, charging the owners and recovering the cost either summarily or as Private Improvement Expenses. The owner may after the second notice appeal to the Local Government Board." Sec. 6: "No house may be built or rebuilt without a proper supply of wholesome water under a penalty of £10. A certificate must be obtained from the medical officer of health, and if refused the owner may appeal to the Local Government Board." Sec. 7: "Rural sanitary authorities shall from time to time inquire into the condition of the water supplies within their district, and may spend money on analyses or otherwise for the purpose." They shall also have right of entry under secs. 102 and 103, Public Health Act, if they have reasonable grounds for supposing a supply to be insufficient. But for the sanction implicitly given to inaction by the word *may* in place of *shall* in sec. 3, these clauses would be fairly satisfactory were it not for a further loophole afforded by the use of the words "a reasonable distance," which may be anything that the arbitrary discretion of the magistrate or of the owner himself may decide. A quarter of a mile has been pronounced a reasonable distance for children to carry every drop of water in pails, while the wholesomeness of the water is a matter with which the authority may or may not trouble itself.

But supposing the authority to be animated by the best intentions, they may find themselves hampered, if not paralyzed, by the law itself. There should, of course, be some limit to the expense to which an owner may be put, but the language of the saving clause is ambiguous, and it has been decided that it must be interpreted as if it applied to one house only. Thus, an owner of six houses might be compelled to provide each with a well if he could do so for £6, or even for £8, per house; but he cannot be compelled to expend £24 on one larger well, though he might supply all the six thereby at a cost of one penny per week for each, instead of two pence, and at a capital outlay of £24 in place of £36 or £48.

The greatest difficulty is encountered in places where the soil consists to a depth of 100 or more feet of clays, in which there are no water-bearing strata. Such are the formations known as the Gault, and the Kimmeridge and Oxford clays. Here it is necessary to go beyond the immediate vicinity, which neither the owner nor the Local Authority can do, and the only remedy lies in a resort to the County Council, on which the supreme responsibility should devolve. It should be empowered to authorize or compel the formation of water-boards for the supply of combined districts devoid of means of supplying themselves.

The following are a few of the most glaring instances that have come under my notice:—

1. Bailey Hill, Birdbrook, Essex.

Nine cottages approached by an almost impassable road, the obligation to repair which is disclaimed by the local authority, while the owner threatens to close them if he is put to any expense. Five of them have 25 inmates, and two families have to walk 100 yards to reach the pond on which the cottages depend for water, the nearest other source being over a mile away.

This pond is fed by the surface-drainage of ploughed fields and a ditch. The surface was covered with a thick green scum, and the water was dark and muddy. The cottagers had to strain it and to let it stand for some hours to clear further. When disturbed by rain or by horses being led into it, it showed many anquillulæ, small red-worms, and it was always full of animalculæ. Close by and within a few yards of the ditch is a privy used by sixteen or more persons, which, after heavy rain, overflows into this ditch, and the contents of the cesspit when it is emptied, perhaps once a year, are thrown on the surrounding ground, whence much must be washed into the pond.

Twenty-three persons used this water, and the children were constantly suffering from sore throats, diarrhœa, etc.

2. HEVER NEW TOWN, KENT.

Six or seven cottages, well-kept by respectable tenants. Two wells, one abandoned several years ago, being poisoned with sewage, as the result of an examination after an outbreak of fever. The water of the other, the only source of supply, is turbid, with a nauseous taste. So the occupants use a roadside-pond, which receives its water from the drainage of the road, the adjoining ditches, and the manured fields around, and is unfit to drink.—[E. HOOK, F.R.I.B.A.]

All wells in the neighbourhood are bad. The water of one of these, which had been popularly reported the best, gave on analysis:—

	Grs. per gall.		
Total Solids	67·4 xx.	Oxygen absorbed in 15′ .	0·032 x.
Loss on ignition ...	5·4 x.	„ „ 4 hours .	0·074 x.
Chlorine	8·1 xx.	Total hardness	24·8 x.
N as Nitrates	1·32 xxx.	Permanent „	13·4 x.
Free Ammonia ...	0·02	Appearance in two-foot tube, turbid, and green.	
Organic Ammonia ...	0·15 x.		

x, xx, xxx indicate degrees of excess.

3. A farm and good cottages on the Gault had no source of water but a pond at the crossing of roads and the ditches along the road-side, receiving the drainage of cultivated fields. Yet within sight, high upon the Wiltshire Downs, could be seen a large lake or reservoir of the finest water, which could be supplied by gravitation to all the country round, but is used exclusively for feeding the Kennet and Avon canal, though some of the cottagers occasionally obtain surreptitiously a supply from the open channel by which the water is conducted. The water is beyond the district, and therefore beyond the competency of the local authority.

4. In another village the supply came directly or indirectly from a brook, which, rising from a spring at some distance, traversed several acres of highly manured vegetable gardens and allotments, then ran along the roadside through the village receiving the surface drainage and, at the time of my visit, overflowing part of the road. From this "brook," receiving in its course the drainage of manured land and the washings of the road, the cottagers took their supply. A substantial farmer had what he called a well, but which was really an underground tank fed by a pipe

from the brook, and by the rain-water from the roof of his house; others resorted to like expedients, though the clergyman, whose house was at some distance, allowed his poorer neighbours to draw from his deep well for drinking and cooking purposes.

5. I casually observed, in passing through a Cornish village, men, women, and children, carrying water in pails from a stream, where it crossed the road under a bridge at the bottom of a gorge, towards which the storm-waters must have carried all kinds of pollution, and which as it came down from the hills like a cascade received the overflow from a cesspit-privy on the bank.

There are villages in all parts of the country on pervious soils, alluvial, tertiary, chalk, sand, or limestone, where shallow wells yield an abundant and, perhaps, constant supply. Each cottage has its well, but each has also a privy near the well, in more or less pervious soil, so that the liquid soaks downward into the ground-water or directly into the well. Such pollution, if poured on the surface of the ground, would, in percolating through the upper soil, undergo complete nitrification, but starting from a point six to ten feet below the surface, where the earth is devoid of bacteria, it is, though clarified, not purified, and makes all such wells a source of danger.

In one village, where diphtheria and enteric fever were rarely absent, I was successful in obtaining the abolition of the privy-pits and the substitution of earth-closets, the contents of which were utilized in the gardens, with the result that the fevers had, a year later, entirely disappeared. Shallow wells will always be the source of water for a large part of the population, and if cesspits were abolished and the wells raised a foot above the ground-level, so as to prevent the entrance of surface-drainage, vermin, etc., they should be safe.

I may call attention to two simple expedients for the protection of wells. One suggested by Dr. Woodforde, Medical Officer of Health for the Berkshire Combined Districts, is to substitute for brick steining glazed stoneware drain-pipes two to three feet in diameter, placed one above another with sockets downwards and spigots upwards, the topmost section standing a foot above the ground; the other is the substitution for the ordinary bucket (which, besides necessitating the well being open and unprotected, carries with itself all sorts of dirt from the wet and trodden ground on which it rests) of Jonet's patent Water-Elevator. This is a domed cylindrical structure, about the size of a large pillar letter-box, in which two buckets nearly counterpoising are worked by a handle, and as each reaches the top it tips over, discharging the water by a spout on

either side. It is applicable to shallow and deep wells, superseding pumps, and is less liable to accidents than force-pumps. By a simple catch the bucket is prevented from running down if the handle be let go, so that no strength is required to work it, however deep the well.

MR. A. F. SOMERVILLE (Wells) desired to point out that, besides want of means, there were other hindrances to a rural district obtaining a sufficient water supply. The abstraction by larger towns from rural districts of their natural supply of water without any provision for a compensating supply was one; another was the attitude of district councils towards this question. As a chairman of a county sanitary committee, he had had considerable experience in dealing with rural district councils: while some were ready to provide good supplies, others not only delayed dealing with the question, in spite of reports year after year from their medical officer of health, but also permitted the erection of many new houses in their district where no supply was available. Rain-water supplies were, in his experience, by the insertion of a filter, excellent in some instances.

MISS C. COCHRANE (Rural Housing and Sanitation Assoc.) considered that the medical officer of health must be placed in a better position if his recommendations were to be followed, and referred to the need of power on the part of the Local Government Board to enforce sanitary regulations.

DR. J. J. WEAVER (Southport) referred to the great need of systematic examination of rural water supplies, and instanced, as showing this need, the case of a village in Wales where he was staying, and where, on examination of the well, he found in it many dead and decomposing mice and frogs, and the remains of a dead mole.

DR. SIDNEY DAVIES (Woolwich) referred to the contaminated water supplies of rural districts being a frequent source of outbreaks of enteric fever in towns after the summer holidays. The public ought to have some means of knowing what was the water supply of all places, however small, wherever visitors come for seaside or country holidays. It was desirable that the Local Government Board or the Registrar of Births and Deaths should obtain and circulate an annual return as to the water supply of all places which were frequented as health resorts, which would state at least whether there was a public supply, or if not whether cesspools existed.

MR. F. F. GRAFTON (Bollington) asked a question as to the method of forming the inverted cement joints in Dr. Woodforde's stoneware drain-pipe well lining, and pointed out the advantages in reliability to be gained by keeping the socket upwards.

Dr. Gerard C. Taylor (Finchley) said that it was not altogether fair to expect analysts to report definitely on the potability of a given water supply merely from the examination of a sample. Detailed information should in every case be supplied to the analyst as regards the source of the supply, especially in respect to possible sources of pollution and the nature of the strata in the immediate neighbourhood.

Mr. William Whitaker (Croydon) said there was more difficulty as a rule in getting public supplies for small places than for towns, because of the want of means. Therefore it was all the more important to take care of such sources of supply as existed and to protect them from pollution. For instance, wells should not have their tops flush with the surface, but should be carried up a little above the ground so as to prevent dirt, etc., getting down the well. Again, cesspits should be so situated as to avoid risk of contamination to wells, instead of being placed where they were practically certain to pollute the water. In the clay-tracts, where there were no springs and no shallow wells, a supply could be generally got by the collection of the rain that falls on the roofs; but this should be done with care, so as to prevent pollution in the channels that carried the water, and in the receptacles in which it was kept. As regards public supplies for villages, where two or more were near together, and where no one village could afford the cost, the right plan was for them to band together and to carry out a joint scheme.

LIGHT IN DARK ROOMS.

By SIDNEY DAVIES, M.A., M.D.Oxon.
Medical Officer of Health, Woolwich.
(MEMBER.)

IT has long been recognised that light is one of the essentials of health, and as we are not yet able to obtain a perfect substitute for daylight at a sufficiently cheap rate, properly lighted rooms must be taken to mean those that are sufficiently lit with daylight.

Light is necessary to health: Because it directly promotes the vital processes which are necessary to life; because dark rooms mean dirty rooms; because light, especially sunlight, is antiseptic to the germs of disease, and notably to tubercle-bacilli; rooms artificially lit with gas, the usual alternative to daylight, are still unhealthy, though modern improvements have diminished the unhealthiness.

And yet there is no definite provision in the Public Health Acts for ensuring that dwelling and work-rooms are properly lighted. The provisions for underground rooms separately occupied require a window of a certain size, and doubtless the Acts had in view daylight as well as ventilation, but light is not mentioned in the Public Health Act, 1875, or in the Public Health (London) Act, 1891. The only way in which dark rooms can be dealt with is by declaring them to be a nuisance or injurious to health. The Borough Council of Woolwich has obtained a conviction in a case where a front basement room was proved to be dark, this being the only nuisance complained of. The room was not separately occupied or used for sleeping; it was lighted by a window looking into a small area, having over it a grating through which alone light could be obtained, and it was proved that large print could not be read in the middle of the room on a clear day an hour before sunset. The Medical Officers of Health of Greenwich and of Woolwich gave evidence both of the room being dark, and their opinion that light was essential to health. For the defence it was shewn that the tenants had occupied the room for over twenty years and were still alive. An order was made to abate the nuisance with

23s. costs. Additional light was provided by increasing the width and height of the window and the width of the area, and replacing the grating with one in which the bars were at right angles instead of parallel to the front of the house.

The principle causes of darkness are:—Insufficient size of windows; windows wrongly placed, *e.g.* in a corner; room underground with area of insufficient width, or covered over; street too narrow to give a sufficient angle of light; back additions; trees obstructing the light.

It is not proposed to discuss all these heads fully, but simply to mention a few instances of how light has been supplied in my own Borough. During the past five years, windows have been provided or enlarged, or additional light provided, at several hundred houses.

One very simple mode of obtaining light is the use of whitewash for the surface of areas, adjoining and opposite walls, and interior surfaces. The whitewash needs renewing once a year. For areas whitewashing is a temporary expedient; coating with glazed bricks is preferable and often of great utility, if the area is sloped at the right angle.

One of the simplest and cheapest means of improving light is the use of highly refractive glass, such as Muranese and, better still, prismatic glass. Muranese glass has a raised pattern and prismatic glass is fluted in straight lines; both have one plain surface, which should be outside and the ribs of fluted glass horizontal. This kind of glass has the advantages of refracting the light so that it does not all fall on the floor near the window, and of making curtains and blinds unnecessary for purposes of privacy. The use of such glass for increasing the light of offices and workshops is well known, but it is not likely to be used for dark living-rooms, unless at the instance of the sanitary authority.

When a forecourt exists it is possible in some cases to increase the light of basements by sloping off the area at a larger angle, and tiling its surface. When there is no forecourt and the area is necessarily covered with a grating the nature of the grating is of importance. The bars should be narrow but deep, and they should be set at right angles to the house wall, and not parallel, as usually found.

But in many dark basements very little light can be obtained unless the window can be raised in height. In most windows the larger part of the light enters near the top, and this is especially the case in underground rooms. Often the height of the window cannot be raised without encroaching on the floor of the room above. In three cases in Woolwich this difficulty has been overcome by cutting away the rafters, fixing a trimmer, and constructing a bulk-head in the room above. The result

was very satisfactory in each case. In other houses when the height of the basement-room was under 7ft. the floor has been lowered 12in. or 18in., and this has increased the lighting of the floor and furniture.

In cases where a basement has consisted of an underground room in front and a room above ground-level behind, the party-wall between the rooms has been removed for the greater part, the two rooms thrown into one, and a large, fairly well lit room obtained.

In cases, however, where it was attempted to gain additional light for a dark room by constructing a glazed window in the upper part of the party-wall, the result has been unsatisfactory, as might have been foreseen.

To lighten the room to the greatest advantage, the window needs to reach to the top, and to be nearly in the middle of the wall. In one case a room with a good-sized window was badly lighted owing to a high wall a few feet off, which almost wholly prevented direct rays of light entering the room. But the window did not reach to within 18in. of the ceiling, and by raising it 12in. light was enabled to enter direct from the sky, and the light was doubled. In other cases rooms have been dark owing to the window being in a corner, or at one side of the wall; in such cases a small additional window has been constructed.

Where trees appertaining to the house obstruct the light, the remedy is obvious: if, however, the trees are on the property of another owner, the matter is more difficult; but a representation to the owner has frequently had the desired effect. In one case the front rooms of half a street were dark, owing to high ground opposite on which were a number of overhanging trees: the ground appertained to army-barracks. A representation was made to the commandant, and after a little delay all the obnoxious trees were cut down, with very marked improvement to the houses.

The use of outside reflectors, as in city offices, has not so far been found practical for living rooms.

Second in importance to the lighting of living rooms is that of *staircases and passages*, though here the primary object of a window is usually ventilation. A passage and staircase without a window has been held in London police courts to be a nuisance, where the house was occupied by more than one family, but a prosecution would probably fail in any other case. Little difficulty has been found for the most part in Woolwich in making a moderate sized window on a dark staircase.

The cost of putting a small window in an external wall to light a staircase is not much, the district surveyor's fees being frequently the most serious part. When there is no exterior wall, a skylight can some-

times be made, but this is less satisfactory, as it is difficult to clean and to keep out rain, and the cost is greater. Failing a window, glass panels in bedroom-doors are useful to a small extent, but the chief substitute for a window as regards light is a light-coloured paper or other wall-surface frequently renewed.

The above refers only to old houses. It might be thought that at this hour of the hygienic day it would be unheard-of for a house to be built in which there was a living-room not well lighted. But even the stringent provisions of the London Building Act do not prevent such cases.

One of the commonest means of defeating the Act is the erection of back additions of such extent as to shut off most of the light from the back rooms of the main part of the house; in addition to shutting off light they necessitate the windows being squeezed to one side of the room, so that a large part of it is always in shade. When the yard between two adjoining back additions is covered with a glass roof (allowed in the London Building Act under the title of a conservatory), not only is most of the light, but also the air, excluded from the rooms. New houses on old sites may still be built without sufficient provision of light, and new houses may be built so as to shut out light from existing ones.

The London County Council has proposed amendments to the Building Act which will remove some of the difficulties pointed out above; but it appears that the only satisfactory way of ensuring that the dwelling-rooms of new houses are sufficiently provided with daylight is to enact that no new house shall be occupied unless each habitable room is certified to be properly lighted by daylight.

With old houses what is wanted is a further definition of nuisance, as "any dwelling-room not provided with proper means of lighting by daylight."

But let not any sanitary reformer wait for legislation. The prospect of obtaining any useful sanitary measures or amendments seems remote indeed, and meanwhile I can only express the hope that all sanitary authorities may make as good use of the existing Public Health Acts as the Woolwich Borough Council has done.

ALDERMAN DUNK (Folkestone) stated that the back additions to houses frequently encroach upon the light to the back rooms in the main building, and suggested that in the framing of by-laws maximum measurements should be fixed to prevent this curtailment of light.

CREMATION: ITS BEARING ON PUBLIC HEALTH.

By ALBERT C. FREEMAN, M.S.A.
Author of "Crematoria in Great Britain and Abroad."

ABSTRACT.

A DECISION given by Justice Kekewich, in a case recently heard in the Court of Chancery, will mean the closing of half the cemeteries around London, and burial-boards will have to purchase large tracts of land in order to provide a neutral zone. Mr. Stephen Goddard applied for an injunction to restrain the Hythe Burial Board from using their cemetery within 100 yards of his dwelling-houses. Mr. Justice Kekewich held that "interments must not take place within 100 yards of any dwelling-houses in burial grounds laid since 1855, unless the owner's consent was obtained." The Court of Appeal has upheld the decision of Mr. Justice Kekewich, with a result that the Beaconsfield (Bucks) Burial Board are in a dilemma in regard to their new burial ground, they having been threatened with a similar action.

There can be little doubt the legislature when framing this part of the Burial Act was faced with the fact that inhumation was a danger to the health of those living in the immediate neighbourhood.

The object of placing a dead body beneath, rather than upon, the surface of the ground, is that the earth may absorb and neutralize the products of decomposition. This result is imperfectly accomplished. Investigation shows that the earth does not purify the body placed in it, but that noxious gases escape into the atmosphere, and germs of specific diseases are incorporated with the water which percolates from a cemetery, so that air and water are polluted, to the serious danger of the living. Sanitary science has taught us truths so important as to the pernicious effects of placing dead bodies in the earth, that, but for the blind Conservatism of the human race, we should be surprised that this method was not long ago supplanted by some system which would effect quickly and advantageously that which goes on in the grave slowly and mischievously.

After all the arguments in favour of earth-burial, there is a danger attending it that we must acknowledge, that of premature burial.

Under the existing laws it is possible for a medical man to certify the death of a person without seeing him, and many bodies are buried without any examination having been made to ascertain that death has occurred. The Premature Burial Society of England are bringing a Bill before Parliament to amend those laws, and so to prevent the burial of a human being while in a state of trance or coma.

The ex-Home Secretary stated that in five years there had been no fewer than 53,000 cases of burial without the cause of death being stated; how many of these were prematurely buried, to awaken in the grave? An investigation of some of our cemeteries would readily tell us.

It is said that the victim of catalepsy might meet an equally horrible fate in the crematory! But before any municipal body or cremation society will undertake the cremation of a body, they demand a certificate, stating the cause of death, from two independent medical men. Then in the event of those opinions being of a mistaken character, that death had not occurred, there could be no return to consciousness, no suffering or pain, for the high temperature, 1,800°, would instantly stop the action of the heart, and death would be painless.

It is said that the practice of cremation might destroy the evidence of crime, such as poisoning by criminal or irresponsible physicians. It must be admitted that cases of criminal poisoning, such as would be detected by an exhumation and examination of a buried body are very rare. In the majority of cases, the cause of death is evident to any physician. In the case of a medical man wishing to dispose of his victim, he would not send it to the crematory, knowing that two certificates setting forth the cause of death are needed. He would send his victim to an undertaker and embalmer, and, having had the vital organs containing proofs of poison removed, would cause the body to be buried in the earth. The present loose system of certification of death forms an open door for the poisoner's victim. Verification, and the cause of death, in the event of cremation becoming a universal practice, would make the protection against poisoning and other secret crimes be greater, rather than less, than at present.

Cremation took its origin in the first stages of human culture. The burning of human remains was the general practice of the ancient world, except Egypt, where the bodies were rendered harmless by disemboweling and embalming. In China they were buried, or left unburied in and on the earth, which custom has inflicted many a grievous plague and devasta-

tion among its people. In Rome, from the close of the Republic to the end of the fourth Christian century, burning was the general rule.

The people of Burmah cremate their rich dead and inhume the poor or carry them to a stream. Cremation spread to Europe from India; from Asia by way of Thrace it probably reached Greece. The ancient Etruscans practised cremation, adopting it from the Greeks, who were their first rulers and afterwards their close neighbours. In our land cremation was the general practice of the early British.

Let us see how unobjectionable is the process of cremation and its surroundings. The ceremony which accompanies the incineration of a body need not be changed from that which is now conducted at a burial. There is nothing to add depression to a gathering necessarily sad. As the mourners bring in the body, the coffin is placed upon the catafalque while the burial service is being read; subsequently withdrawn from the chapel into the cremating chamber at the rear, to be, within an hour, reduced to inoffensive ashes.

At the completion of incineration the ashes are swept into an urn to be deposited in a niche in a church, chapel, or columbarium. They may be buried in the earth, or scattered to the four winds.

Some advocate that columbaria should be dispensed with; but there is a sentiment, particularly among women, which will not readily die out.

If the ashes serve no good purpose, they cannot do any harm, and the amount of land occupied by the storage of a million urns, containing ashes, is so small that it is not, from a financial point, worthy of consideration. If the urns are deposited in our churches, they will decorate the buildings, and also lead to the adoption of the old custom of burying the remains of the dead within the churches of God.

Are we willing that, after death, our bodies shall be so disposed of, that they shall constitute an element of danger to our survivors? If we answer, "Yes," then let us continue the present practice. If we do not desire this, let us unite for the purpose of establishing a better system.

ISOLATION IN FEVER HOSPITALS.

By T. W. ALDWINCKLE, F.R.I.B.A.

(FELLOW.)

I BRING before your notice to-day a subject which will be of interest, being particulars of a new departure made by the managers of the Metropolitan Asylums Board in connection with their numerous infectious hospitals. This relates to the isolation of patients suffering from, or suspected to be suffering from, scarlet fever, diphtheria, or some other infective disorder. This question arose some years ago in connection with the subject of "return cases," where a patient discharged from a hospital as cured infects, or is alleged to have infected, another person on returning home or elsewhere.

The percentage of discharged patients giving rise to return cases is not large, but the managers were desirous of ascertaining whether steps could be taken to reduce it, and under their instructions Prof. Simpson investigated cases extending from October, 1898, to March, 1899, and subsequently Dr. Cameron investigated cases extending from July 1st, 1901, to the end of July, 1902, his work involving nearly 900 enquiries. The results of these investigations were embodied in two reports, that of Dr. Cameron being a lengthy one, dated March, 1904. He recommended amongst other matters, that separate isolation should be commenced at admission with a view to the further observation of the patients and a classification of cases, and that after a probationary period of a fortnight or three weeks in the admission cubicles, it might then be safe to transfer the uncomplicated cases to the general wards as in the present system, but that the complicated cases should either remain in these cubicles until they had recovered, or if convenient, they might be transferred to specially reserved wards.

The principle thus recommended is, in fact, that of treating every incoming scarlet fever or diphtheria patient as doubtful, and of isolating such patient for a period long enough to exceed the period of incubation of any other or secondary infectious disease, such as measles, which the patient may have had before entering the hospital.

There are good reasons for adopting this principle. Hitherto the

usual practice has been to receive patients into general wards containing from 8 to 24 beds, according to the construction or size of the hospital; cases of obvious concurrent infections, or obviously wrong diagnosis, being placed in isolation wards, having one, two, four or six beds in a ward, and being in separate buildings called isolation blocks or pavilions.

But although these obvious cases are immediately isolated, there must of necessity be a large number of doubtful cases sent to fever hospitals, of both scarlet fever and diphtheria, owing to error in diagnosis, and it is a well known fact that the proportion of these errors in diagnosis is increasing, and that many cases find their way into the general wards.

There are also the cases, already referred to, of patients suffering clearly from scarlet fever or diphtheria, which ultimately develop another infectious disease after having been some time in the general ward, the patient having contracted this disease also, before admission, but the disease not having developed at the time of admission.

The admission of such secondary diseases is greatly to be avoided as it has very serious results. In the first place, it may convey the infection to other patients in the ward, causing complications and possible death. In the next place, it at once destroys the usefulness of that ward. The case itself is, of course, at once removed to an isolation ward, but the remaining patients must necessarily be "*suspects*," and for a period no new patients can be put into that ward. Nor can the remaining patients be transferred. These disabilities in a ward for 20 beds are serious, as they throw out of use a number of beds for some weeks. There being no less than 10 acute fever hospitals under the Metropolitan Asylums Board, it will be easy to realise the importance of this subject.

We come, therefore, to this conclusion, that as it is impossible, in receiving a case, to decide that it does not contain the germs of another but undeveloped infectious disease, that such cases are numerous and frequently cause mischief, and that trouble also arises from errors in diagnosis, the safe course is to treat every case as doubtful, and to administer the hospital accordingly.

This means, therefore, that every incoming scarlet fever or diphtheria patient must be isolated for a period varying from a fortnight to three weeks, to be afterwards transferred either to the general wards or to a convalescent hospital; and the question arises what shall be the nature of the isolation? Shall the patient be in a separate room, *i.e.*, a room closed in with walls or partitions from floor to ceiling, or will the isolation afforded by cubicles, *i.e.*, spaces enclosed by partitions about 7 ft. high be sufficient?

It will be convenient at this stage to inquire as to what has been done elsewhere in the matter of special isolation.

The Pasteur Hospital at Paris, opened in 1900, has two pavilions in which special isolation of this character is provided. There are two pavilions identical in design, in which are treated in separate single bedrooms by the same attendants, cases of smallpox, scarlet fever, diphtheria, and other infectious diseases, the number of cases from October, 1900, to March, 1904, having been 2,745, and this with only 8 instances of infection having been conveyed from one patient to another.

The isolated bedrooms are arranged in pairs, three on each side of a central corridor, each pair being separated from the next by a brick wall, while the partitions in front and in the centre of each pair, reaching from floor to ceiling, are glazed from about three feet above the floor level. Each pair of patients can therefore see each other, and can be seen by the nurse without entering the ward. There is an airing verandah outside each ward. Each room is 11 ft. 2 in. long, 9 ft. wide, and 15 ft. high, giving a cubic space of 1,508 feet per bed. In each bedroom there is a lavatory basin with hot and cold water laid on for the use of the doctor and nurse. The patient thus being completely isolated, the conveyance of infection from one patient to another by either nurse or doctor is prevented by keeping both of these officials in a condition of asepsis.

As this hospital is designed for the isolation of infectious diseases, it may be useful to quote the description which Dr. Louis Martin, the resident physician has given of the arrangements for insuring asepsis.

"Here are, in a few words, the precautions which we deem indispensable. There are, first of all, those which the staff must observe in an absolutely rigorous manner. The doctors and the nurses have in the hospital a dress and special shoes, which they must take off each time they leave the pavilion. The doctors and the nurses should not enter the patient's room without sufficient cause; when they are obliged to enter they put on a blouse which protects their clothes. All the linen which they use for examining or washing the patient is in the bedroom; all the instruments, stethoscopes, etc., are immediately boiled. Finally, when the doctors or nurses leave the bedroom, they take off their blouses and wash their hands with soap and sublimate, and wipe with a towel, and, if necessary, wash their face if it has been soiled. All these precautions having been taken, they can, without risk, visit another patient. All food utensils, after each meal, are boiled for a quarter of an hour in water alkalised with carbonate of soda." *

* From *Le Bulletin Medical*, Paris, 19th March, 1904.

At the Infectious Hospital of the Walthamstow Urban District Council at Chingford there has recently been opened a special isolation pavilion for twelve beds. These, again, are isolated rooms, each room containing 2,000 cubic feet, the partitions reaching closely from floor to ceiling. They are in two groups of six, back to back, with the Nurse's Duty Room between so that every one of the twelve rooms can be easily seen into from two observation windows. All the partitions are glazed with plate glass in very large squares, the sight-line of the glass being only 26 inches above the floor, so that patients lying in bed can see each other, and also be easily observed by the nurse. Although the rooms are back to back, cross ventilation has been secured by fresh-air ducts under the floor. Each room is entered directly from the open air under a glass verandah.

The arrangements for ensuring asepsis on the part of the doctor and nurse are somewhat similar to that at the Pasteur Hospital, with the exception that, in this instance, there is one lavatory basin for every two rooms, and that these are placed in the verandah instead of in the ward.

The Ward "Henri Roger" in the Hospital for Sick Children, Paris, 98 × 23 ft. and 14 ft. 9 in. high, formerly a general ward for the treatment of non-infectious diseases, has been adapted for the isolation of doubtful cases, and divided into twenty cubicles, ten on each side of a central passage, each cubicle having a large window. The cubicle partitions are 6 ft. 10½ in. high, and glazed, and each cubicle has a glazed door. There is a space of 2 in. between the floor and the bottom of the partition, the object being the free circulation of air. The arrangements for securing asepsis for doctor and nurse are similar to those at the Pasteur Hospital.

One of the wards in the Hospital for Sick Children at Paris has been fitted up with "partial cubicles," *i.e.*, dividing partitions (glazed), but with no enclosure in front, and consequently no door. These partitions also stand a little clear of the floor. As to the absence of the partition in front of the cubicle, Professor Grancher, who speaks from experience, in advocating such an arrangement, says: "If the nurse is aseptic a door is not required; if the nurse is not aseptic the door will not prevent the entrance of infection." But this is not the whole of the matter, as I will explain later on.

Dr. Cameron, in his report already referred to, states that "In the hospital for the treatment of scarlet fever and diphtheria in New York the same strict antiseptic precautions are practised. Each patient has a private room, there being no wards. Patients are carefully examined before being admitted, and if there is any question in regard to diagnosis

they are placed in the observation room. The resident physician, before entering the presence of the patient, is required to wash his hands thoroughly with soap and water, followed by immersing them in bichloride solution, 1·2000. A gown is supplied which buttons closely round the neck, covering the collar, and enveloping the body completely, just clearing the floor. To this is added a cap arranged to cover the head and neck, exposing only the face. This with a pair of rubber over-shoes completes the uniform. When he leaves the patient his hands and face are disinfected thoroughly, and the mouth is cleansed with boric acid solution."

I will now describe the isolation arrangements about to be carried out at the fever hospitals of the Metropolitan Asylums Board, premising that we are in the experimental stage, and that we shall commence with one or two hospitals only, although the managers have decided that the principle shall eventually be applied to all.

It has been decided, after consultation with the medical superintendents of the Board's hospitals, that the cubicle system of isolation of incoming patients is the most suitable, and one likely to prove the most effective in preventing the introduction and spread of secondary infection, and of preventing the trouble arising from errors of diagnosis.

It is considered that the risk of aerial conveyance of infection from one patient to another in a well ventilated ward, divided up into cubicles, is so slight as to be almost negligible in the case of mild attacks, which constitute so large a proportion of doubtful cases, and that it is now generally believed that the infective element in scarlet fever and diphtheria is conveyed almost exclusively by personal contact. Therefore one-bed isolation rooms, completely enclosed from floor to ceiling, should be unnecessary, as well as undesirable and costly. On the other hand the partial cubicle, with the open front, could hardly guarantee that separation of patients essential to prevent infection by personal contact. This is especially the case as regards children suffering from scarlet fever (by far the most numerous class in our hospitals), as the present type of this disease being mild, the children usually leave their beds at a comparatively early stage, and must therefore be kept within a confined area such as is provided by the cubicle.

The cubicle system has many advantages. It is economical in first cost, it is easily adaptable to an existing ward, and it affords ample facilities for good cross ventilation. As regards the last, if the ward in which the cubicles are to be placed is already well ventilated, there will be nothing in the cubicles to materially injure that ventilation. This adapt-

ability of existing wards for cubicle purposes is important, as it is in the wards of fever hospitals that these new arrangements would be first adopted.

To deal first with the cubicles at the South Western Hospital: these are arranged on each side of two existing wards, having a corridor in the centre. The central fireplaces and chimney stacks presented a difficulty which has, however, been got over. In most existing wards there will, obviously, be some difficulty or the other to be surmounted. The ward is 100 feet long, 28 feet wide, and 14 feet 6 inches high. It originally contained 18 beds, and as there will be 16 cubicles, there will be a loss of two beds, or 11 per cent. As a rule the loss of beds under the new arrangements will work out at about 15 per cent.

Each cubicle will have a floor area of about 120 square feet. The partitions are 7 feet high, and go down to the floor. The raising of partitions a few inches clear of the floor for the purposes of air circulation has this disadvantage, that children (the majority of patients) might pass articles to each other through this space. The partitions are of 2-inch steel framing, the lower portion filled in with asbestic panels, the upper portion, commencing about 2 feet from the floor, being glazed with 32-oz. sheet glass. Plate glass would be preferable, but we wish to be economical. The partitions will stand upon hard wood fillets, rounded on both edges so as to avoid a bad angle against the floor. The finish against the walls will be similar. The partitions are therefore fire-resisting, a matter of importance where patients are individually isolated.

The doors will be dwarf doors 3 feet 2 inches high, sufficient to prevent a child from getting out of the cubicle, and low enough to admit a free current of air. Gilmour doors will be used, which being of hard wood are practically fire resisting. They are so placed that the door of one cubicle is not opposite that of another. Each cubicle has one large ward window with double-hung sashes, and hopper sash over. As the floors of these wards are of deal, 35 years old, we are replacing them with teak.

There are hot water heating pipes running round the wards which will be sufficient to warm the cubicles, while the corridor and the general air space above all will be warmed (in addition) by the central fireplaces, which will also act as exhaust ventilators. There are fresh air inlets in the external wall of each cubicle. There will be ample cross ventilation by means of the windows. This is an illustration of how the existing warming and ventilation of a large ward lend themselves naturally to the cubicle arrangement.

The arrangements for insuring a condition of perfect asepsis on the

part of the doctor and nurse will be upon the same lines as at the Pasteur Hospital. An overall hanging in the cubicle will be put on upon entering and removed on leaving, when the hands will be washed in a lavatory basin. All instruments used in the cubicle will be sterilised in an apparatus in the sanitary turret, and all food utensils coming from the cubicle will be sterilised in the ward kitchen after each meal.

As regards the lavatory in the cubicle, which will be used for washing the hands of anyone entering, we propose an arrangement somewhat different from that at the Pasteur Hospital or the Walthamstow Hospital. At these institutions the basin has a plug and chain, and hot and cold water taps. To do away with all this, we provide a basin, on brackets, and three or four inches clear of wall and partition, which, while having a waste-pipe, has no plug and cannot therefore be filled. Instead of water-taps which must be handled in order to be used, we provide a pedal action spray to discharge tepid water at a convenient height over the centre of the basin. The nurse can thus wash her hands in a running spray of continuously clean water. The basin has also a flushing rim, so that it cleanses itself each time it is used. Hot and cold water are laid on to a mixing valve, set to produce a tepid temperature, and fitted with a thermometer, there being one mixing valve to each range of four or six basins.

The relative positions of the bed, door, and lavatory should be such that the nurse should not have occasion to go near the bed in passing from the lavatory to the door on leaving the cubicle.

As the patients in these cubicles will be mostly in the acute stage of the disease bed-pans will be mostly in use. One w.c. is, therefore, sufficient for the 16 cubicles. There are also provided a bed-pan sink, a scalding sink, and a portable bath.

For the same reason as last mentioned, few arrangements will be necessary for airing the patients. Such few cases as might be suitable will be taken one at a time into the airing yards, in charge of a nurse. At the Pasteur Hospital balcony verandahs are arranged for the isolated rooms, but I understand that they are seldom used except for cases of plague, when special isolation is observed by entering the bedroom from the balcony instead of from the central corridor. We originally arranged balcony verandahs in connection with the cubicles at the South Western Hospital, but these have been abandoned, as it was considered that the greatly increased cost would not be justified by any equivalent advantages.

In the proposed cubicles in two of the new wards at the South Eastern Hospital, the arrangements are similar to those at the South Western

Hospital, except that we are not troubled with central fireplaces, and thus obtain cubicles of more uniform size and shape. Here the cubicles have a floor area of 141 square feet. Each ward, which as a general ward contained 24 beds, will take 20 cubicles, a loss of 4 beds or 16 per cent.

The warming and ventilation of these new wards are carried out without fireplaces. The cold fresh air is brought in through the external walls at the floor level, and is warmed by passing over and through radiators inclosed in cases. The vitiated air is removed at the ceiling level by fans capable of removing 5,000 cubic feet per bed per hour, thus also producing a strong intake of fresh air through the radiators and cases. This arrangement, as intended for a general ward, fits in exactly for the cubicles, as there are a window and radiator and case in each cubicle.

The question of cost is important, as if this principle is to be generally adopted a large number of cubicles will be required. It is estimated that the cost, including the spray lavatory, will not exceed £30 per cubicle, assuming that the ward is in a fair state of repair.

[*For Discussion on this Paper, see page 513.*]

ISOLATION HOSPITALS IN RURAL DISTRICTS.

By J. COOKE HURLE, M.A.Camb.

Alderman, Somerset County Council; Chairman, 1892–95, *of the Keynsham Rural Sanitary Authority, and Chairman,* 1895–1904, *of the Keynsham Rural District Council.*

IN the country the percentage of cases that require removal is much smaller than in towns. The population is scattered, and while there will be many cases which cannot be effectually isolated if left in their own homes, yet there will also be a considerable number of cases which can be left at home without much risk of spreading infection. Again, the population within removal distance of a country isolation hospital is not large, and the hospital will not infrequently be vacant for considerable periods.

Further, the rateable value of a country-district is small compared with that of a town, and the incidence of rating less fair. An undue proportion of the rates in rural districts is borne by those engaged in agriculture; and the rural governing bodies are largely composed of the ablest men of this class. Hence local expenditure is more carefully scrutinised, and more reluctantly granted in the country than in towns.

For these reasons the type of hospital which the Local Government Board endeavour to force on country districts is a type which the country districts will seldom voluntarily agree to erect. The Board will, for the purpose of a loan, only approve of a stone building constructed in an exceedingly substantial manner, and so contrived as to admit of two kinds of infectious disease being treated at the same time without risk of inter-infection, and with offices for staff planned on the basis of continuous occupation. The Board also make the further condition that the hospital shall under no circumstances be used for isolating cases of small-pox. In short, they say to every rural area, however small and poor, "we will not permit you to borrow money to provide an isolation hospital unless you put up one that is suitable for a populous and wealthy town; that will cost anything from £300 a bed upwards."

I will now give an account of an isolation hospital of a different type erected in a rural district in North Somerset thirteen years ago.

A case of small-pox occurred in 1893 in the capital of the district, a county town of 3,000 inhabitants. The Sanitary Authority erected as

rapidly as possible an iron block with kitchen and nurses' room, and two wards designed for six patients each, w.c.'s and bathrooms; a detached iron cottage, and a third building (also detached) to house a steam disinfector and ambulance, and to serve as a mortuary. Gas and water had to be laid on from some distance, and sewage disposal was effectually provided by sub-irrigation; solids as well as slops being thus dealt with. At first six beds for patients were provided; and the total cost was £732, which included road-making and fencing. There was no payment for land, this was already the property of the guardians. Soon afterwards a small iron building for laundry purposes was erected, and from time to time beds were added until the number reached twenty. These brought the cost to about £900, or about £45 per bed.

As there have frequently been considerable periods during which the hospital has not been used, the permanent staff consists only of a caretaker and his wife, who occupy the cottage above mentioned, together with garden ground, and receive a small weekly wage. While the hospital is empty, the man looks after it, doing painting and small repairs and keeping it in readiness for immediate use; he also disinfects in the steam disinfector all articles sent to be so treated. When the hospital is occupied, he maintains communication between it and those outside, and his wife is employed in cooking and washing, the wages being increased. Arrangements are made with a local medical practitioner to give medical attendance at a fixed weekly fee during such periods as the hospital may be in use; and it has been found practicable to obtain a nurse or nurses without delay when cases are sent in. The cost of maintenance when the hospital is not in use thus averages but little over twenty shillings weekly.

Within six months of its erection it was instrumental in stamping out three introductions of small-pox, the disease being in each instance confined to the first case and cases which had been actually infected from the first case before notification. Since then the hospital has been of great value in preventing the spread of several outbreaks of diphtheria and scarlet-fever; notably, in 1896, when scarlet-fever patients were removed to the hospital from five parishes in the district; and in 1901, when forty-six cases of diphtheria were treated there, and the district medical officer of health, while pointing out its shortcomings, stated in his annual report that it had been invaluable.

The number of cases of infectious disease in the district, but for the means of isolation thus provided, would have been more numerous. It is certain that much sickness, suffering, and premature death have been prevented, resulting not only in the saving of expense throughout the

district on these heads, but also in the prevention of losses which are not assessable in terms of money. Further, the benefits of this hospital are not confined to this district, for the district exports to Bristol and other large cities considerable quantities of milk; and the hospital, by reducing infectious disease, reduces also the possibility of the milk becoming a carrier of infection.

The question of encouraging district councils to establish and maintain isolation hospitals is thus of importance.

Encouragement can be given under the existing law. In the first place the Local Government Board might grant loans for short periods for the erection of such hospitals as I have described. After all, they do their requisite work of providing a safe place for isolation. No death has yet occurred in the hospital I have referred to, though it has been occupied in winter as well as in summer. It is unnecessary to purchase land for a hospital of this type. A lease for twenty-one years will about last the life of the building, and will be easier to obtain, for a landowner would often be willing to grant a lease for a comparatively short term while he would not be willing to part with the land in perpetuity; and is there not some advantage in the perishable character of the building? The ideal hospital of to-day will not satisfy the ideals of to-morrow. There is no standing still. Medical science progresses fast, and the structural requirements of the ideal hospital vary accordingly. A costly stone building, up-to-date in every detail, may well be found antiquated, inconvenient, and in need of considerable structural alterations, after a quarter of a century; the bricks and mortar, the joists and roofs, may be as sound as the day the hospital was opened, and yet the value of the building as a hospital may have dwindled seriously.

Secondly, a county council may give pecuniary assistance: the Isolation Hospitals Act, 1893, allows county councils to contribute both to the structural expenses and to the establishment expenses of isolation hospitals.* Now it is as important to contribute to the establishment charges as to assist in the erection of the hospital. The hospital abovementioned has been erected thirteen years, and in five of those years it has not been opened at all; the Medical Officer of Health has always had to make out a strong case of urgency to induce the district council to open it. There have been several occasions when he has thought it desirable to open it, but has failed to obtain the sanction of the council

* The Act, for some reason difficult to understand, does not allow county contribution to the patient's expenses, but these are defined to consist of food and medicine; medical attendance and nursing are establishment charges.

to do so on account of the expense, often considerable. The feeling of reluctance on the part of district authorities to incur the expense of removing cases to hospitals might be materially decreased by the adoption of a liberal scale of grant; the principle would not be a new one; grants have now to be made by county councils to many of the district expenses, workhouses, pauper lunatics, salaries of district medical officers of health, and inspectors of nuisances.

It may be desirable to have means of dealing with outbreaks of small-pox independently of the provision of isolation hospitals for other infectious diseases. A possible method of preparation would be to secure, by annual payments, the right to erect in suitable localities temporary hospitals; the spots selected might be twenty miles apart, for small-pox patients can be taken ten miles to hospital. If a serious outbreak occurred temporary buildings could be erected in a very few days. The most troublesome thing of all, the obtaining a site, would have been accomplished before the outbreak, instead of after it. The provision of such sites might well be undertaken by and at the expense of the county.

[*This Discussion applies also to the paper by* Mr. T. W. Aldwinckle, *page 504.*]

Mr. A. Saxon Snell (London), referring to the Pasteur Hospital, said the isolation did not appear to be thorough, and it was difficult to see how air could be prevented passing from one room to the other by means of the corridor. It was noted with respect to the Children's Hospital at Paris that the dividing partitions are kept two inches off the floor. It would scarcely seem that these partitions would prevent air travelling from one room to the other. If Mr. Aldwinckle were erecting a new building, would he not rather adopt the principle shown in the Walthamstow hospital?

Dr. Neech (Halifax) referred to defects in the present system, and stated that in his opinion the cellular system was a step in the right direction, though he doubted if even that method would be successful in stamping out scarlet fever. Return cases had been referred to and were stated to be comparatively few, but his point was that if a patient returning home is able to infect persons in the home, he would be also able to infect others.

Mr. John Pearson (Folkestone) said he was not in favour of isolation hospitals, as wherever they had been built it had led to the attack rate of scarlet fever being doubled, and they had been the cause of nearly all the diphtheria, by creating post-scarlatinal diphtheria, as throughout the Midlands and the north diphtheria was practically unknown until isolation hospitals were introduced.

Referring to Gorton, the cost last year of home isolation of scarlet fever was only £68, but had 80 per cent. of the cases been removed to isolation hospitals, as had been done in the surrounding districts, the cost would have been £1,360; and with the home isolation a lower attack rate was experienced than in the other adjoining districts with hospitals. In Mid-Warwickshire the districts without isolation hospitals had an attack rate from scarlet fever of 2·6 per 1,000, while in districts with hospitals it was 4·8. In Stockton-on-Tees, before the isolation hospitals were built, the cost of scarlet fever and all other infectious disease did not exceed £200 per annum, diphtheria was practically non-existent, and the cases of scarlet fever were about 100 a year. Since the isolation hospital had been built, it had been enlarged three times, the cost was now £2,900 a year, scarlet fever cases were now from 400 to 700 per annum, and diphtheria had increased a hundredfold. At Leeds the attack rate of scarlet fever had doubled in ten years with hospital isolation; and this was the result all over the country. Home isolation was much cheaper and gave far better results.

Mr. Charles Brownridge (Birkenhead) considered that the Local Government Board should, in the case of corrugated iron buildings, grant a loan for their erection for a reasonable number of years. Present hospitals could be adapted to the cubicle system by the provision of suitable screens and all the advantages of the system gained thereby.

Dr. F. W. Martin (Brighouse) said that isolation hospitals were chiefly provided for the working classes, who by their aid were afforded in many instances means of continuing their work and so supporting their families. Return cases had been very few in Brighouse during a period of eight years. He was of the opinion that these hospitals were necessary for the benefit of the middle and working classes, especially in factory towns.

Dr. T. H. A. Valintine (Dept. Public Health, New Zealand) said as regards the alleged failure of hospitals to limit the spread of scarlet fever, an analysis of some 4,000 cases in New Zealand showed that the incidence rate was greatest in those districts where hospital accommodation existed. On the other hand, the mortality rate was greatest in districts unprovided with hospitals. In one large health district the mortality rate was over eight per cent. On those grounds the Health Department was advising the erection of small temporary hospitals for those few cases which would require hospital treatment. The life of such buildings was regarded by architects as thirty years.

Dr. J. J. Weaver (Southport) said that he agreed with the last speaker in his views as to the need of improved administration of existing hospitals, especially as to preventing overcrowding. He agreed also that there was much to be said both for and against isolation hospitals, though in some towns, such as health resorts, it seemed to him an absolute necessity to provide these hospitals;

otherwise it would mean financial ruin to large numbers of their inhabitants who owned boarding houses, whenever an infectious case broke out in them. He had also found that districts often differed markedly in the incidence of scarlet fever, independently of whether there was an infectious diseases hospital or not; so that it was ridiculous to assume that the number of cases in a town was always connected with the presence or absence of an infectious diseases hospital. In Southport and Birkdale, for instance, two adjoining and similarly situated townships, and both with infectious diseases hospitals, there was always a considerably greater number of cases of scarlet fever in Southport than in Birkdale, yet as far as he could see there was nothing in the hospital arrangements to explain this difference. Referring to Mr. Aldwinckle's paper, he thought many of the arrangements in modern hospitals were of a rather fancy character. For instance, while elaborate arrangements were made to prevent a nurse soiling her fingers with a water-tap, the overall that the doctor wore was left hanging up in the infected hospital atmosphere. He thought possibly home isolation was the really ideal method, but if they were to have it they must see that every house was provided with a spare room for isolation, and that every family was financially able to provide a trained nurse to look after the patient. Until they got that, they must be content with hospitals.

MR. W. F. BIRD (Midsomer Norton) suggested that the Local Government Board should be urged to grant short loans for temporary isolation hospital buildings in rural districts, subject to approval of sites and plans of structure.

MR. ALDWINCKLE (London), in his reply, said that many of the points raised in the very interesting discussion were of a strictly medical character with which he, as an architect, did not feel competent to deal. He should, however, like to say a word as to the question raised by Mr. Snell and Dr. Neech as to the relative suitability of single bed wards or cubicles for the purposes of the isolation which was needed for the scheme under discussion. The primary object of this isolation was to prevent the spread of a secondary disease from one patient to another, and it was the opinion of those medical superintendents most competent from their experience to judge, that the isolation afforded by cubicles was practically sufficient, it being considered only necessary to prevent the personal contact of the patients (together with complete asepsis on the part of the doctor and nurse) and to ignore the very remote risk of aerial conveyance of infection. It was therefore unnecessary to employ "cellule" or closed-in single-bed wards, which were more costly and less capable of being ventilated. The cubicle was easily fitted up in any ordinary existing ward, at a small cost, it involved no structural alteration to the ward, and adapted itself to the ventilation of the ward. In this climate through ventilation by means of windows on opposite sides was the most natural and effective system to use, as there were usually over three hundred days in the year when the windows in a ward could be kept open without injury to the patients. He quite endorsed the views of

Mr. Cooke Hurle as to the advantages of lightly constructed buildings for isolation hospitals in rural districts. So long as care was taken to have the buildings of a non-inflammable character, lightness of construction was no disadvantage. Not only was the cost very much less than that of brick or stone buildings, but the rapidity with which they could be erected was of great value in cases of emergency. He gave this opinion as the result of his experience in connection with some 1,800 beds provided in buildings of this nature, both large and small, erected under his supervision.

[*The Proceedings of the Congress will be continued on page 517.*]

NOTES ON LEGISLATION AND LAW CASES.

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UNSOUND FOOD.—*Offences—Article "liable to be seized"—Article in possession of Purchaser—Liability of Vendor—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 47, sub-s. 3.*

The respondent, a wholesale dealer, sold to a retail pork butcher a quantity of pigs' plucks, one of which was unsound, unwholesome, and unfit for the food of man. The unsound pluck was seized in the purchaser's shop by the appellant, a sanitary inspector, who obtained an order for its destruction. In proceedings against the respondent under s. 47, sub-s. 3, of the Public Health (London) Act, 1891, for selling an article liable to be seized and condemned under the section, the magistrate found that the unsound pluck was not exposed for sale, and would not have been sold or offered for sale by the retail shopkeeper until the sanitary inspector had passed it, and he accordingly, without calling upon the respondent, dismissed the summons, holding that no offence had been committed under sub-s. 3:—

Held that the magistrate was wrong in stopping the case; that a *prima facie* case had been made out against the respondent calling for an answer; and that the case must go back to the magistrate to be proceeded with.

Per Lord Alverstone C.J.: Sub-s. 3 of s. 47 is intended to deal with the case of the vendor of an article intended for the food of man, which in fact at the time it is sold by him is in such a condition that it is liable to be seized, that is, in the condition of being unsound and unfit for the food of man.

Per Channell J.: The words "any article liable to be seized" in sub-s. 3 means any article *prima facie* liable to be seized by reason of its condition.

Reg. v. Dennis [1894] 2 Q.B., 458, considered.

GRIVELL v. MALPAS, Div. Ct., Vol. II., K.B., 32.

Volume XXVII. No. 10. Issued November, 1906.

JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

CONGRESS AT BRISTOL.

SECTION III.—PHYSICS, CHEMISTRY, AND BIOLOGY.

ADDRESS

By W. N. SHAW, Sc.D., F.R.S.
(FELLOW),

PRESIDENT OF THE SECTION.

CLIMATE AND HEALTH.

IN a paper read before the Royal Statistical Society last year I mentioned that among the questions asked by inquirers of the Meteorological Office the one which recurred most frequently was the apparently simple question, "What is the driest, warmest, and sunniest part of the British islands?" The question has always some relation to therapeutics, and is typical of that side of scientific investigation which endeavours to trace a connection between the health of the community, or of certain of its members, and the physical or chemical conditions of the air by which they are surrounded. The investigation is, as yet, in its infancy. It is extremely interesting, but very difficult. From the form in which the question comes to me, asking merely for a general and authoritative statement as to the dryness, the temperature, and the sunshine of the various parts of the British Isles, it has an appearance of simplicity that is really illusory. It reads as though a knowledge of certain physical conditions of the atmosphere were all that is wanted for the discrimination of different localities as suitable or unsuitable for rheumatic subjects, yet I would certainly not be rash enough to say whether the apparent effects of different climatic conditions are to be ascribed to physical, chemical, or biological conditions of the atmosphere.

Among the possibilities of chemical constitution we must now include the presence of a certain amount of radio-active emanation, which, accord-

ing to Dr. G. C. Simpson's summary* of our knowledge of this subject, is derived from the ground. It is supplied to the atmosphere by the "breathing" of the soil under variations of pressure. It is, therefore, specially abundant when the air is comparatively stagnant, and is likely to be found in localities where the soil is specially porous. Taking this into account with other things, we must regard the physics, the chemistry, and the biology of the atmosphere as closely bound up one with another, and I need make no apology for putting before you some considerations about the physical conditions of the atmosphere in different parts of our islands as an introductory address to the section of this Congress which has the cosmical title of "Physics, Chemistry, and Biology."

The general question of the relation of climate to health is now being taken up in the most comprehensive manner by a committee of the British Association appointed in South Africa, under the chairmanship of Sir Lauder Brunton, with Mr. Barcroft as secretary. This is, therefore, a peculiarly fitting time for a review of some of the features of the investigation, in so far as it is concerned with the knowledge of the physical conditions of the atmosphere obtained from climatological observations.

I am afraid that I must devote the greater part of what I have to say to pointing out the difficulties of co-ordinating in an effective way the enormous body of facts that make up our knowledge of climate rather than to discussing achieved results.

But before I do that, let me refer to the curves representing the parallelism between the average seasonal variation of deaths from rheumatism and those from erysipelas, taken by Dr. Longstaff from a paper by Dr. Buchan and Sir Arthur Mitchell, and reproduced in his "Studies in Statistics, 1891." These curves are sufficiently clear evidence that there are underlying connections between the season and the mortality due to certain diseases, and that the trouble of the examination of the statistics will prove remunerative in the end, if we have the patience to collect them and the intelligence to use them in the proper manner.

In his lucid annual reviews of the mortality tables drawn up for the Registrar General, Dr. Tatham has called attention on several occasions to the favourable effect of years of equable temperatures and abundant rainfall, as regards death-rate, and his remarks suggest many lines of inquiry. For example, are these favourable periods of equable climate advantageous on account of the physical effect of the warmth and moisture, or does the comparative immunity from death of those years arise from the reserve of strength accumulated in the experience of years of wider variation, which,

* Quarterly Journal, Royal Meteorological Society, Vol. 31, p. 295. 1905.

while they overstrain the feeble margin, leave the great majority stronger than before? To put the question in its most general form, is uniformity or seasonable change the more desirable characteristic of climate?

CLIMATOLOGICAL STATISTICS.

Let us now turn to a consideration of the climatological information which is available for dealing with questions of the relation of weather to health. Whenever I have been asked the question referred to, I have had to reply that the short answer, that would turn away wrath in such cases, implies the co-ordination of a large body of statistics under various limitations not expressed in the question. I have been obliged to offer to the inquirer the crude meteorological statistics for a number of places and to ask him to draw his own conclusions therefrom. I acknowledge, frankly, that such a course may be disappointing, and even exasperating, and I will now endeavour to indicate the lines upon which an approach might be made to answering that and other questions of a similar character.

The ordinary meteorological observations which give us information about the physical condition of the air relate to 1, the barometer; 2 the direction, and 3, the force of the wind; 4, the temperature of the air at fixed hours; 5 and 6, its maximum and minimum in 24 hours; 7, the temperature of evaporation, that is, of a surface of muslin wet with water, at fixed hours; 8, the amount of cloud, at fixed hours; 9, the amount of rainfall in the 24 hours; and 10, notes, not always exhaustive, upon the occurrence of various incidents such as fog, dew, hoar-frost, thunder or lightning. These particulars are generally given in official publications for each day for a few stations in connection with the meteorological organisations of each country in which such matters are systematised.

For the large majority of stations, however, monthly summaries are published. Experience and international co-operation have led to the adoption of a common form for the publication of the results, and these monthly schedules for various parts of the world practically represent the statistical material available for the investigation of any question in connection with the relation of climate and health.

In addition to the statistics which form part of the international scheme, there are a certain number of observations which are sometimes included in the operations of a meteorological station. These additional observations comprise records of the duration of sunshine, and the daily maximum readings of the black bulb thermometer in the sun and the minimum readings of a thermometer exposed on the grass; in some cases

also we have readings of earth temperatures at various depths. On account of instrumental difficulties the readings of the black bulb thermometer are not practically available for the comparison of different stations. An accomplished observer can use them with discretion for detecting variations in the sun's heating power during the day or year or from year to year, but a group of such observations from different localities gives rise to questions which cannot be solved by the mere comparison of results. The readings of the grass minimum are subject to local effects which are not suitable for climatic comparisons, so that neither of these has found a place in the international scheme.

The sunshine recorder also presents some difficulties. Unless its construction is reduced to some common standard, and some convention is adopted for tabulating its records, differences arise that have no real basis in the climatic conditions, but the practice with regard to this instrument has become sufficiently systematised in this country for the main outlines of the variations in the duration of sunshine to be indicated. No high degree of accuracy for the purposes of comparison has been arrived at and no great stress should be laid upon the minor differences shown by the published figures.

The meteorological observations of the kind indicated have now been made in many countries with comparable instruments for a period of about forty years, so that the volume of available material, chiefly in the form of monthly means, is very large. The next question for consideration is how to use it.

The map is, without doubt, the best means of presenting the facts for a comparison of different places with regard to one particular element. It may show the results for a month, a year, the average of a number of months or years, or in some cases for a day. There are, however, very few of the elements for which data exist that are sufficient for the construction of a detailed map, and one constructed from inadequate data is very misleading.

Pressure and the winds associated with it are very easily represented if one does not require minute details. Comparatively few stations are required. The prevailing wind is well indicated by the average run of the isobars. For this purpose the wind must be understood to refer to that experienced in an exposed situation which is the most suitable for a meteorological station: on that understanding there is not much difference between the prevailing winds in different localities in our islands. It is, of course, possible for a particular position to be protected against winds from a particular quarter, by natural features, by trees or by buildings.

Such protection may have an important practical effect upon climate, but it is characteristic rather of a site than of a locality and cannot be adequately represented upon a map of small scale. It can hardly be represented at all in the ordinary meteorological statistics.*

Of the other elements only rainfall and temperature (maximum, minimum and mean) are sufficiently represented by data to be satisfactorily mapped. An excellent series of maps of averages of the monthly values for rainfall and mean temperature is given for many parts of the world in the beautiful Meteorological Atlas edited by Dr. Buchan and published by Bartholomew about six years ago.

It requires a certain amount of practice to combine the information of the various elements from different maps and to take account of variations of the mean values in particular years. In order to indicate some features of the combination, and to show the relation of particular years to the mean, I have obtained from the maps referred to, and from the available data in possession of the Meteorological Office, the material for two meteorological sections across the British Isles. One is from North to South, the other from East to West; and upon them are marked the approximate height of the land, the rainfall, the maximum temperature and minimum temperature at the several stations as given by the average of a number of years, for the wet year 1903, and the dry year 1904. The sunshine values have been given too for those points on the line for which the data are available. The first line (Fig. 1), page 522, starts from Shetland and runs with some zigzags on the eastern side of Britain to Hastings. The second (Fig. 2), page 523, the west to east one, starts from Valencia and ends up by a zigzag across the estuary of the Thames.

Figures for two months, February and August, are represented. The diagrams speak for themselves. The most prominent feature is the way in which the average maximum and minimum temperatures diverge as the line moves inland from the sea. Over the open sea the diurnal range of temperature is probably very small, that represented on the diagram is not, however, based on actual measurement but estimated. Besides the increase of daily range from the coast inland, we may note on the west to east diagram (1) the considerable increase of rainfall as one passes from the coast inland, and the gradual diminution as one passes eastward from the high land; (2) the manner in which this effect of geographical distribution fades in the summer months as compared

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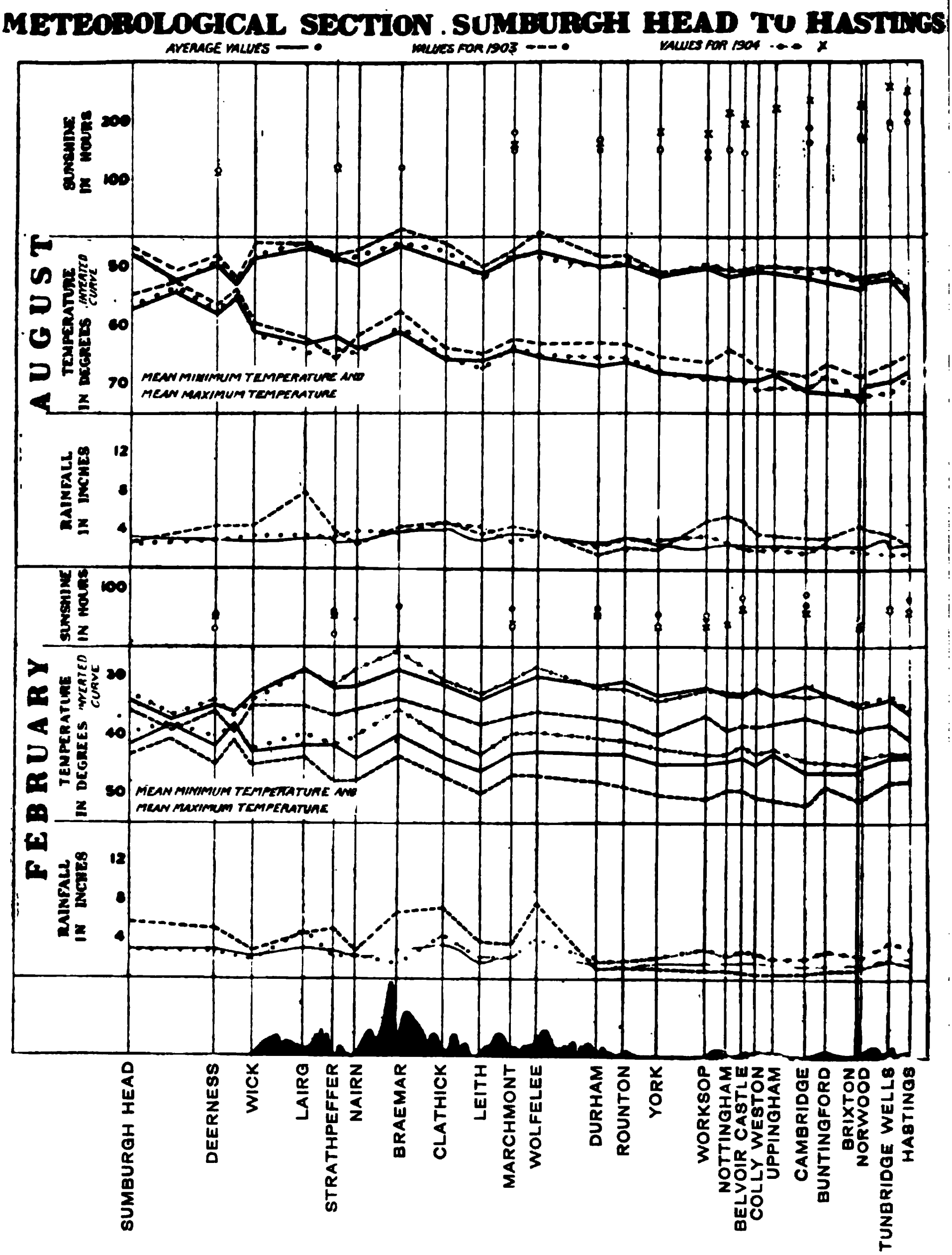
* For evidence as to the uniformity of wind direction at a series of widely distributed stations, see a paper on the Treatment of Climatological Observations, Journal Scottish Meteorological Society, Series III., Vol. 13, p. 3, 1905.

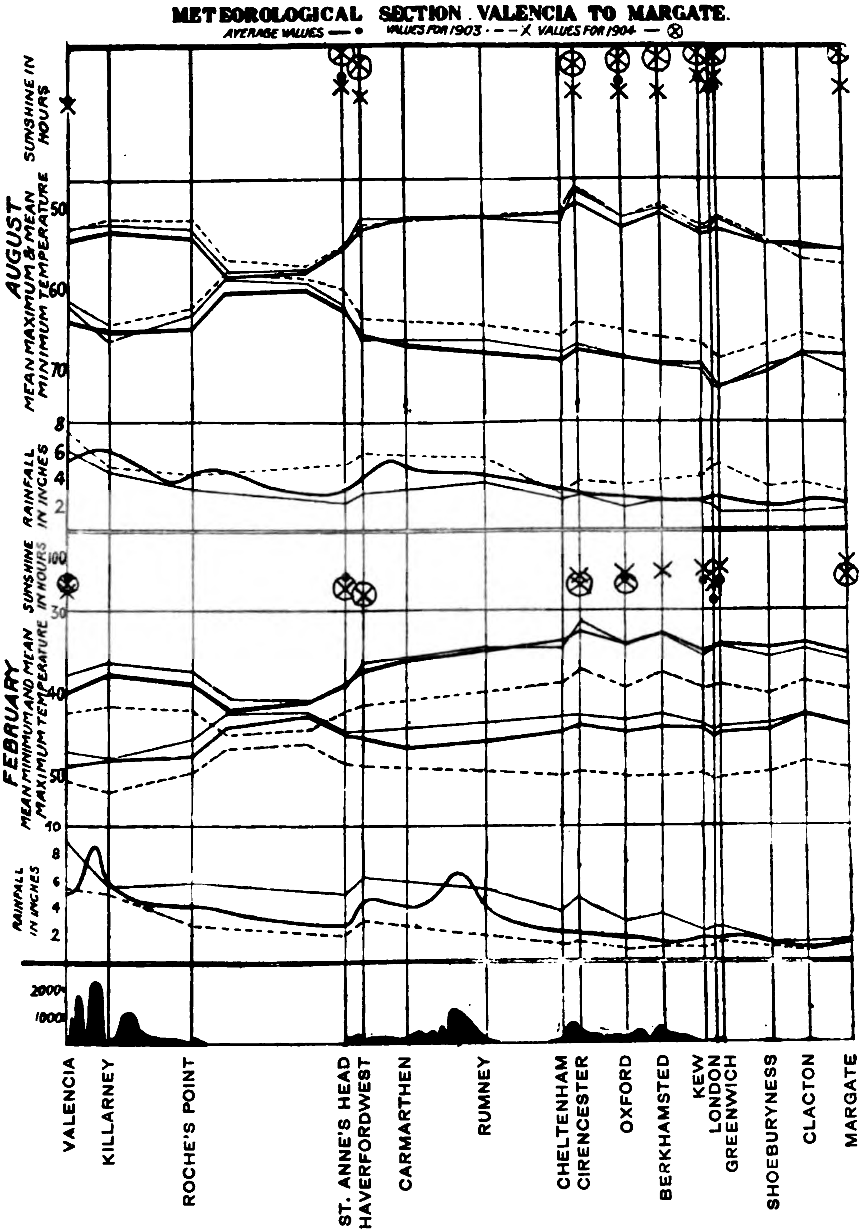
FIGURE I.—*North to South.*



with the winter; (3) the gradual increase of warmth in summer and of cold in winter as one travels eastwards along the same line; (4) as regards the north to south line the comparative uniformity of conditions for all the elements. The differences between Sumburgh Head and Hastings in the winter are really very small for so great a distance.

The general conclusion to be drawn from the diagrams is, that although

FIGURE II.—*West to East.*



the difference of locality and season can be easily identified, there is really no very marked distinction between the climates of the British Isles, and that, in technical language, the incidents of weather are really of more importance than climate, except as regards certain specially mountainous regions. It is much to be regretted that the particulars as to the moisture contained in the air cannot be included in the diagrams. Our information

about this important element is very meagre, and except for the few observations with self-recording instruments, is derived entirely from observations at 9 a.m. and 9 p.m. for the ordinary inland stations, or at 8 a.m. and 6 p.m. for the telegraphic stations, which are nearly all on the coast. The selection of hours is most unfortunate, for they are the hours when change is most rapid, and we get no indication of the dryness of the day or the dampness of the night and early morning.

In many countries on the continent observations are taken three times a day instead of two, and one of the fixed hours is at 1 p.m. or 2 p.m., so that the dry time of the day is represented in the published values.

Seasonal and Diurnal Variations.

In the study of the local variations of physical conditions with a view to any questions connected with health, the seasonal and diurnal variations, to which allusion has been already made, deserve careful consideration, because, if these secondary conditions are different in different localities, the answer to any question may depend upon the fact that a particular locality has the most favourable conditions for a limited portion of the year, or for a limited portion of the day. From an inquirer's point of view, these particular portions of the day or year may be the most important. The other portions, for various reasons, may be of secondary or even of negligible importance.

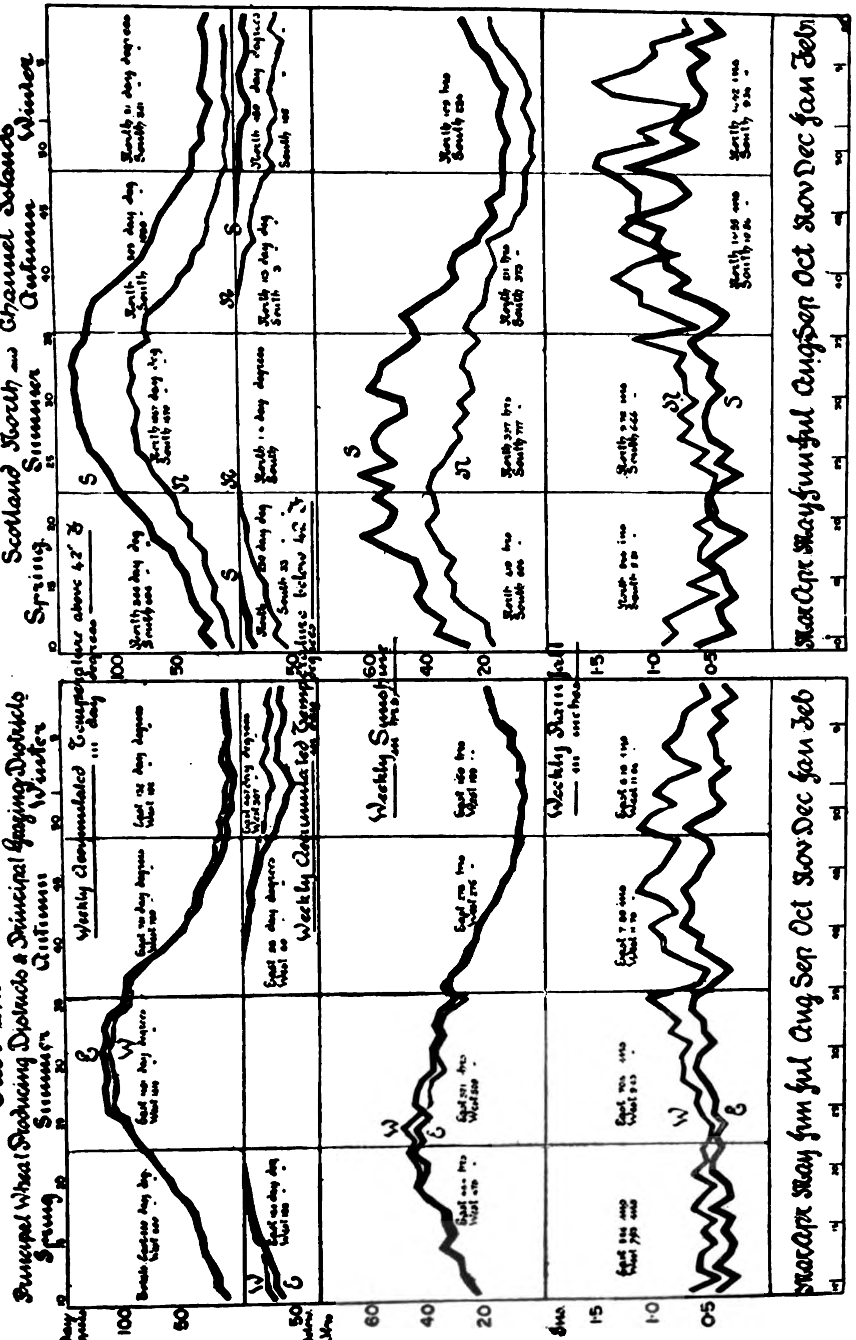
In the winter we live for the greater part of the time in an atmosphere artificially warmed and artificially dried. Climatological observations, on the other hand, all refer to the open air, and in consequence we must distinguish between the conditions in that part of the day when we are indoors, and that part of the day when we may be, or may wish to be, out of doors; or between that part of the year when artificial warming is usual, if not universal, and that part when the artificial modification of atmospheric conditions is given up.

Let me put before you some examples of the variation of the meteorological elements with the season and with the hour of the day.

I take the chart of the average seasonal variation of rainfall, sunshine, and temperature (Fig. 3) from the paper on the seasons already referred to (Journal of the Royal Statistical Society, vol. 68, part II., 1905). It gives only general indications, because the lines on the diagram refer only to certain main divisions of the British Isles, but any inferences which are suggested by the diagram can be examined in detail by reference to the figures from which the diagram has been compiled.

The statistics as to temperature are indicated by the number of accumulated day-degrees above or below 42° F.; thus the figures show the aggregate warmth or coolness of the week or the season, as estimated by its intensity and duration, using 42° F. as a datum line. This method of

FIGURE III.



The Course of the Seasons in the British Isles
East and West
North and South
Spring
Summer
Autumn
Winter
Weekly Sunshine
Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb

indicating the temperature conditions was originally devised for agricultural purposes, but it has some advantages from the special point of view we are now considering. The most disagreeable types of weather in our climate are those associated with temperatures between 42° F. and the freezing point. Dry cold is often said to be healthy, but it is not of frequent occurrence in this country. The cold that we experience is mostly below 42° F., but not far from the freezing point. The diagram shows the weekly average values; and the variations from week to week are considerable, even when one is dealing with the averages of twenty years. The way in which the values for the weeks of a single year may arrange themselves with reference to the mean value may be illustrated by superposing the values for the current year on the lines of mean values for twenty-five years.*

Let us pass on to consider some diurnal variations. Refer first to the curves representing the mean diurnal variations of temperature at the four observatories of the Meteorological Office.† But the most striking changes are shown in the daily curves for relative humidity which show what percentage of the maximum possible amount of moisture is present in the air at any time. Figure 4, page 527, shows the average condition of the air as regards relative wetness or dryness at each hour of the day and night, with the mean values for the day in figures, for four observatories in connection with the Meteorological Office, and for the months of February, May, August, and November. The results are very striking. Note the extreme dampness of the air at Kew at night-time in November, and the extreme dryness of the air at the same observatory for the day hours of May. I might further illustrate this point by some curves of relative humidity taken from an autographic hygrometer at Cambridge. They show the most sudden and extreme fluctuations of that element within twenty-four hours in every season of the year. These striking fluctuations in the comparative dryness or wetness of the atmosphere (which may extend from 20 per cent. relative humidity to saturation within a period of two hours) are mainly due to the diurnal changes of temperature which have already been illustrated, and some of the more rapid oscillations are probably attributable to passing intervals of sunshine. When air is warmed it becomes relatively dry, although the actual amount of water in a cubic foot may not be appreciably altered, and thus in the sunny hours, when invalids take the air, they may find it dry, and they may practically enjoy the advantages of a dry climate if they are careful to return to the artificially-warmed atmosphere indoors when the effect of

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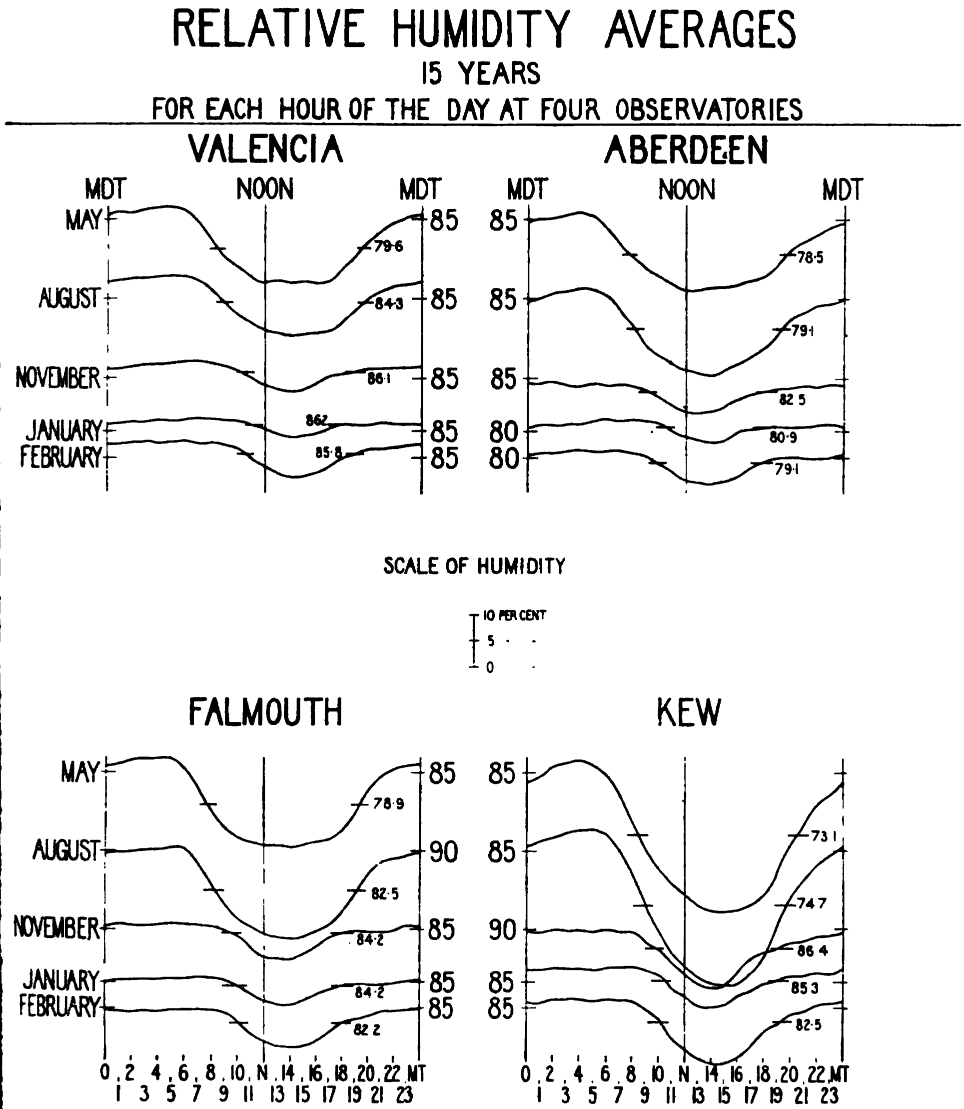
*This is now done at the Meteorological Office by means of tracing paper, upon which the current values are entered, and superposed upon the diagram of average values.

† See "Temperature Tables of the British Islands," Meteorological Office Publication, No. 154. 1902.

FIGURE IV.



the sun's heat is waning. The extent of the variation as shown on an autographic record is beyond anything that would be expected without actual calculation. Outside, however, the air will become moister as the night temperature comes on, and ultimately may be so far cooled that saturation is reached, and fog may even be formed.

Thus a district where conditions are favourable for obtaining widely separated extremes of temperature between the heat of the day and the cold of night may, in effect, be a dry district if advantage is taken of these daily changes, whereas anyone who, like the thermometer in the screen, is out of doors for the whole twenty-four hours may experience a daily

transition from a dry climate during the day, to a moist or even a foggy one in the night and early morning, which may be very prejudicial to health. In the absence of any direct evidence about humidity, it is possible that the temporary dryness of high day temperatures may be made useful even in cold weather, if the corresponding dampness of the night be avoided by staying indoors.

Frequency of Cold and Warm Winds.

Take another point with reference to seasonal variations. Southerly, south-westerly, and westerly winds are generally moist; easterly, north-easterly, and northerly winds are dry. A diagram published in the "Proceedings of the Royal Society" (vol. 69, p. 61, 1901), shows the relative frequency of these dry winds at Kew for the several months of the year, with a very marked maximum in the spring; and another diagram in the same paper shows the effect of these winds upon the normal curve of variation of temperature. At certain times of the year they are conspicuously cold, but at other times their effect upon temperature is much less marked.

General Conclusions.

All the various considerations which have been adduced must be taken into account, in some way or other, before any final answer can be given to a question about the suitability, as regards climate, of a particular locality for special purposes.

The first steps towards such an answer are to decide whether it is possible to restrict the question to the conditions for a certain period of the year, or to the day as distinguished from the night.

With the question thus restricted it is possible to arrange the data so as to give definite information about the physical condition of the air.

Where no restriction is possible, and we are simply left with the bare facts of the incidence of disease and of such climatological conditions as come within the scope of meteorological work, the problem is more difficult. There are two general methods of attacking it, which may be called respectively, the geographical method and the chronological method. The application of the first consists practically in making maps of the distribution of the disease and of the various climatological conditions, and comparing the lines according to which the phenomena group themselves. That of the second, is to trace the variations of the various quantities over the same region for successive intervals of time, and compare the sequences. Both are well illustrated in Dr. Longstaff's book. They are liable to interference of what may be called accidental circumstances. The climatological conditions are not the only elements which affect the prevalence of disease. It may be developed in special localities or on special

occasions through causes which have no direct connection with the physical condition of the air.

The question of the effect of humidity is one of the most interesting of all climatological questions. I was surprised to learn from some of the members of the recent Antarctic expeditions that the sensitiveness to dampness and dryness was experienced even when the temperature was in the neighbourhood of the freezing point of mercury, although the actual amount of moisture in a limited volume of air at such low temperatures is exceedingly small in any case, and the variations in the amount for differences of relative humidity still smaller. Mr. Bruce, the leader of the Scottish expedition, informed me that the ship's cordage was similarly sensitive, and tightened or slackened in damp air or dry air, even at these low temperatures. The whole question of the sensitiveness of the human organism to moisture is very recondite.*

Mr. Tyler has paid much attention to the subject, and his paper† suggests that very moist air is unpleasant, both at high temperatures and low temperatures, while at some critical temperature, about 64° F., the variations of moisture are much less noticeable. If the temperature is high or low, we seem to require that the air shall be dry; but at the particular critical temperature, differences in dryness or humidity produce much less noticeable effects.

I have dealt so far with the material available for the study of questions concerning the connection of climate and health, but in order to give the method of inquiry some practical shape, I should like to suggest the question as to why London is found to be so stimulating a place to live and work in. So far as I am personally cencerned, I contrast it with Cambridge on the one side and to a certain extent with Oxford on the other; I find there is a consensus of opinion as to the existence of a difference between these localities, which are comparatively close together, which I may express by saying that it is easier to go on working in London than in the two university towns, and that the difference is not due simply to difference of social circumstances and habit. It is perfectly evident that there can be no very large difference in the condition of the atmosphere, and if we look for an explanation in that direction, we must deal with rather fine distinctions. The months that I have selected for the sections referred to on p. 521 are not very suitable for this particular inquiry, for London is certainly not at its best either in February or August, so I have taken out the figures from the data for other months as well, and with the following results:—

* Reference should be made to Prof. Travers' paper on The Absorption of Water by Cotton and Flannel, read subsequently in the Section, in which attention is called to the fact that the capacity for absorbing water by these materials increases as the temperature diminishes.

† W. F. Tyler, Journal of the Balneological and Climatological Society.

		Oxford.	London.	Cambridge.
FEBRUARY—	Maximum Temperature ...	45·1°	45·7°	45·7°
	Minimum Temperature ...	34·3°	34·7°	32·3°
	Sunshine	66·4 hrs.	33·6 hrs.	73·7 hrs.
	Rainfall	1·70 ins.	1·59 ins.	13·8 ins.
	Humidity, 8 a.m.	91 per cent.	89 per cent.	91 per cent.
MAY—	Maximum Temperature ...	60·9°	62·2°	62·3°
	Minimum Temperature ...	43·5°	44·6°	42·0°
	Sunshine	196·3 hrs.	167·1 hrs.	202·4 hrs.
	Rainfall	1·75 ins.	1·67 ins.	1·84 ins.
	Humidity, 8 a.m.	79 per cent.	73 per cent.	79 per cent.
AUGUST—	Maximum Temperature ...	69·2°	71·8°	71·7°
	Minimum Temperature ...	52·9°	53·6°	51·8°
	Sunshine	184·9 hrs.	168·0 hrs.	188·9 hrs.
	Rainfall	2·38 ins.	2·39 ins.	2·39 ins.
	Humidity, 8 a.m.	82 per cent.	79 per cent.	84 per cent.
OCTOBER—	Maximum Temperature ...	55·6°	56·8°	56·7°
	Minimum Temperature ...	42·1°	42·9°	41·0°
	Sunshine	102·7 hrs.	68·7 hrs.	105·3 hrs.
	Rainfall	2·76 ins.	2·73 ins.	2·35 ins.
	Humidity, 8 a.m.	91 per cent.	89 per cent.	93 per cent.

There is really not much to be extracted directly from these figures in reply to my question. The most conspicuous feature is the smallness of the London sunshine. One can hardly write that down as being to the advantage of London. Leaving that out of account, there is a persistent elevation of minimum temperature in London, and this may be connected with a corresponding increase in the effective dryness of the atmosphere. But if that be the whole explanation the human organism must be regarded as a much more sensitive instrument than the thermometer, and great hygienic effects must be attributed to very small meteorological causes.

This leads me to my final conclusion, that if we would identify the real relations between climate and health we must be prepared to consider the indirect influences of small differences in climatological data. Perhaps there are other associated effects, such as air circulation, in which larger differences might be observed, but of which we have no adequate measures.

Perhaps we must look for variations in the electrical, chemical, or biological properties of the air, to which I have already alluded. About these we have at present hardly any information at all.

I hope I have given a sufficient indication of the kind of material which we already possess. There is a good deal of it which has never yet been fully co-ordinated, and the most urgent requirement at the present time is the trained intelligence of the worker to detect the underlying sequences. I can promise anyone who is disposed to attack this important subject, not only an abundance of material for his consideration, but a number of questions sufficiently difficult to find occupation for skill and even for genius.

DUST AS A FACTOR IN THE PRODUCTION OF DISEASE.

By PHILIP BOOBBYER, M.D.
(FELLOW.)

ABSTRACT.

IT is not my intention to attempt to give you an exhaustive essay on this very large subject, but it will be my aim as the opener of a debate upon it, first, to remind you of the divisions of the subject which usually attract attention, and then bring to your notice certain others which are not usually included, but are nevertheless highly important.

Writers like Drs. Arlidge and Ogle, Greenhow and Zenker, have made us familiar with many specially dusty occupations, variously classified, but all of them possessing, though in an extremely variable degree, one common sinister feature, viz., a tendency to produce disease of the respiratory apparatus, principally through irritation. Few industries can be said to be free from dust. Dust of one kind or another indeed is almost ubiquitous, and men and animals spending the greater part of their lives in modern cities acquire black or mottled lungs through the inhalation of carbon and dark solid matters into their respiratory tubes. Anyone who has a slight catarrh affecting the larynx, or who takes the trouble to wash out his nose each morning, can verify this statement in some measure by noting the dark and often black tint of the secretion coming from these vestibules of his air passages.

The high death-rates from tuberculous phthisis and other diseases of the respiratory apparatus, specially noticeable among the workers in dusty occupations, are an indication of the injurious influence of dust. The latter acts for the most part in the first place as an irritant, disposing the tissues to take on various forms of inflammatory degeneration, in very much the same way as injured plant tissues become the prey of fungoid growths. We must not forget, however, that of the dust is specifically poisonous. We hear a great deal now-a-days about particulate infection, and it is quite right to insist upon the fact that specific infection is of this character, and not gaseous or unsubstantial. For it is only by

a correct view of the nature of infection that the popular mind can be instructed in the correct and safe methods of prevention. We medical men know that, with strict precautions against the spread of infection by dust and moist particles thrown into the air, and by soiled utensils, instruments, clothing, and the like, it is possible, even in hospital wards, to prevent the spread of infection from one patient to another.

Now, much as we appreciate the necessity of avoiding dust in dealing with cases of infectious disease within our immediate cognisance, it must be apparent to any thoughtful and intelligent person that we are not sufficiently careful in discouraging its general production and dissemination in the daily life of large communities like those of our great modern cities, among which there must necessarily exist at all times an immense amount of infectious material and pulverized organic matter of very various composition.

I shall not attempt to give an exhaustive list of the varieties of dust, domestic, industrial, and other, which go to form the huge mass of pulverulent detritus of cities. I shall content myself with a few salient examples, to the suppression or elimination of which insufficient attention, in my opinion, has hitherto been devoted by the majority of sanitarians and sanitary authorities. The first I shall mention is the dust of the streets, which, be it observed, is made up of more ingredients than most of the inhabitants realize. The most revolting of these constituents are: the excreta of horses, dogs, cats, cattle, sheep, and pigs, and, in poorer neighbourhoods, even of men. Then we have the sputa and nasal accumulations of poorer persons suffering from catarrh and other diseases of the air passages, the droppings and air-borne refuse from the scavenging carts, and the sweepings from many houses, factories, and workshops, notwithstanding all inhibitive by-laws in this regard. The list could be almost indefinitely extended, but the items I have mentioned are filthy or dangerous, or both filthy and dangerous enough in all conscience, without going into further particulars. When we reflect upon the composition of this road-dust of towns, the dust-raising nuisance of the motor car, so far as towns are concerned, assumes a specially serious aspect.

I will now call your attention to some sources of dust in the home or workplace, which we shall all probably agree in thinking sufficiently serious to call for suppression, if this should be reasonably attainable.

The first things that strike us in this connection, are the mats and carpets which form so conspicuous a feature of all well-furnished houses. These articles of domestic furniture are undoubtedly very fertile sources of infective mischief. We wipe our street-soiled boots upon them, and

they collect, besides, the dust which settles from the atmosphere, and various matters dropped or spilt from hand or table. To make matters worse, in most towns carpets and mats can be, and usually are, swept and beaten in the immediate vicinity of dwellings and public thoroughfares.

As houses are now usually constructed, it is possible, and indeed inevitable, that dust should accumulate under the flooring boards, and irritating and infective materials of various kinds are frequently stored up in this situation in very large quantities. When called upon to disinfect rooms furnished with such flooring after occupation by persons suffering from specific infectious diseases, we are frequently struck with the futility of all attempts at disinfection unless the flooring be taken up, and yet realize that if we go the length of radical and complete cleansing, involving such damage to structure as this, we shall do more harm than good by frightening or irritating the owners of property and making disinfection unpopular with them.

The method of storing and scavenging domestic refuse in most cases leaves much to be desired. Notwithstanding instructive handbills and notices issued from the Health Departments, and the oft-repeated requests of inspectors, male and female, a great deal of organic refuse is stored in the ash-tubs or bins which should be burnt in one of the domestic fires. This refuse is often specifically infective, for a large proportion of cases of the acute specific diseases are nursed at home, and the secretions and excretions emanating from them, with soiled dressings and the like material, find their way into the refuse bins without disinfection of any kind.

There is, of course, little doubt that much of the excessive diarrhœa of towns is due to air-borne poison in the form of dust. From the bath-bun in the pastrycook's window to the child's milk in the private larder, we know that exposed food-stuffs generally afford a nidus for the ubiquitous bacilli of the colon group, and others.

In dry-closet towns like Nottingham, enteric fever shows a marked attachment for poor houses with dry-closets, and some six years ago we had a striking example of dust-infection in the case of this disease, when we were compelled to accumulate large deposits of night soil at the refuse depots of the city. The special incidence of the disease in the immediate neighbourhood of the depots, was so striking as to leave no room for doubt that the infection was carried by the air from the deposits to the surrounding population.

Now, what are we to do to mitigate this undoubted and dangerous dust nuisance of our cities? The answer is obvious, and may be summarized as follows:—

We should (1) Pave our streets as far as practicable with smooth and cleanable materials.

2. Check as far as practicable the deposit of fæcal and other organic detritus in streets, courts, alleys, and yards.

3. Forbid the sweeping of dust and other matters from houses, workshops, and factories into the streets.

4. Stop all dry sweeping of streets, and secure the use of *closed* carts for all scavenging purposes.

5. Forbid the passage of motor-cars at more than, say, ten miles an hour past any house or houses standing within fifty feet of a road or street in any district, and limit their speed to ten miles an hour in all urban districts.

6. Discourage, as far as practicable, the use of carpets in houses, and forbid the shaking of carpets and mats in the vicinity of dwellings and workplaces.

7. Encourage the burning of all organic refuse, including infected materials produced on domestic premises, in the kitchen fires.

8. Pursue a vigorous campaign against the smoke nuisance of towns.

9. Enforce the use of closed bins for the storage of domestic refuse, and see that all public scavenging is promptly, thoroughly and intelligently carried out.

10. Advocate the construction of houses, workshops, and factories of such materials and upon such principles as shall obviate, as far as practicable, the accumulation of dust beneath the floors, and in other situations where, under existing conditions, it is liable to harbour.

Finally, let it be our constant aim to minimize the generation of dust in all populous places, and, where its production is inevitable, to secure the adoption of all reasonable means of keeping it out of the general atmosphere.

This subject is a very large one, and all I have endeavoured to do is to draw attention to a few sources of injurious dust specially prominent in connection with the life of cities. I am no revolutionary enthusiast; I only wish to indicate certain directions in which we, as practical sanitarians, might advantageously exercise more care than has been our wont hitherto.

PROF. BOSTOCK HILL (Birmingham) said the question was so vast that it was impossible to deal with all the points raised, and he proposed only to say a few words on dust in relation to scavenging, and to what is generally termed motor dust. As regards the former, he could not speak too strongly on the horrible

method so often adopted of removing the household refuse in barrows from houses and allowing it to remain on the surface of the road till the cart came round. It must be remembered that dust was with us before the motor car came, and that every motorist suffered as much if not more than other people from the dust on roads. But prejudice must give way to knowledge, and we have yet no definite information as to the real effects of outside dust on health. The effect of sun and wind is very different on external and internal dust, and while last year was a dusty and dry year, and motors were on the roads in larger numbers than ever before, it must be remembered that it was the healthiest year on record. Road dust is a disgusting nuisance to the senses, but evidence is as yet wanting that on the whole it has a material effect on health.

DR. RIDEAL (London) wished to protest against the term motor dust. There was no such thing; he suggested the longer but more accurate term, the dust nuisance arising from horse droppings and the action of horse hoofs on the roads. In towns and roads flanked with houses, he hoped authorities would not only lay the dust but remove it and sterilise it. He believed a vacuum remover was capable of being adapted to the cleansing of roads in dry weather, and by electrolysing the salt solutions which were now largely used as dust preventers, sterilization could be effected with little additional cost. In country districts, the dust nuisance in narrow lanes could under existing highway laws be minimised by enforcing the law that hedges be kept cut back; this further ensures a longer life to the road surface, and more safety to the traffic at corners and cross roads. A good deal of the house dust was road dust, so that these remedies for the latter would diminish the former. If rubber overshoes were fashionable in this country, as in the States and on the Continent, they could be removed before entering the dwelling or sleeping rooms, and thus prevent much road dust entering them. This sanitary precaution had long been enjoined even from the time of Moses, who knew that the outside dirt on the sandal would defile the Holy ground.

PROF. KENWOOD (London) said that he was in agreement with practically all that Dr. Boobbyer had said with reference to dust. But there was one recommendation which he did not understand. Wearing apparel must frequently be freed from dust, and if this was not to be done outside the walls of the dwelling where was it to be done? Clearly not inside, where the dust would concentrate and be far more dangerous, unless it could be extracted and collected by a vacuum process. Personally he would strongly advocate the brushing of all wearing apparel outside the dwelling. He had recently inspected a large institution in the midlands much resorted to by convalescents, and he was struck by the absence of any suitable provision for brushing the wearing apparel, which, more especially in the case of the women's dresses, must collect dust infected with influenza and, maybe, consumption. In the occupied bedrooms the invariable

presence of a clothes brush testified to the fact that the brushing was done there; which was certainly the very last place where it should be done. In connection with such institutions, hotels, etc., there should be pegs upon the outside of the doors so that the clothes could be hung up; and a servant should remove them in the early morning to a special balcony or outhouse where they could be brushed. The dangers he referred to were real ones, and they were recognised by many Continental architects who provide special leads or balconies in hotels, etc., for the purpose of clothes brushing. As the increasing motor traffic implied a consequent reduction in horse traffic, road-dust should become somewhat cleaner, but all motorists sincerely hoped that suitable means could be adopted to reduce the dust nuisance arising from motor traffic. There were now several methods of service for obtaining practically dustless roads opposite dwellings, and he hoped that the future would provide further facilities in this direction. He thought it was not unreasonable to suggest that the fines imposed on motorists for exceeding the pace limit should be devoted to improving the road, so that the dust nuisance would be reduced to a minimum.

Dr. Meredith Young (Stockport) said the question was of importance, firstly, because of the minor ailments which dust directly caused, such as conjunctivitis, pharyngitis, laryngitis, and so on; and secondly, because by the irritation of the upper air passages and the consequent lowering of their resistance, such diseases as consumption were more easily contracted. This state of things was by no means benefited by many of the dust-laying preparations at present on the market. Irritating as dust itself undoubtedly was to delicate mucous membranes, it could not help being far more irritating when it acted as a carrier of carbolic compounds, calcium chloride, and the like. He therefore condemned the use for dust-laying purposes of any such irritating materials as those named. If dust had to be laid at all, it ought to be done by means of some bland and unirritating oil or similar substance to increase the specific gravity of the dust, and all irritating admixtures should be avoided. He felt convinced that dust plays a fairly important part in the dissemination of typhoid fever. Only last week, whilst he was looking at some privy-middens in connection with a row of houses where there had been a case of typhoid fever, a woman came out of one of the houses and threw into the midden a shovelful of ashes, etc., closing the door afterwards; within a minute or so the chimney or ventilator of the midden began to pour out a dense cloud of very fine dust, which blew across into the doors and windows of some houses about ten yards away; and he thought that if any typhoid infected matter had been thrown into this ashpit and become dry and pulverised, and then carried out through this ventilator to be deposited upon food or eating utensils, then this would be one of the simplest causes for the spread of the disease.

Miss Alice Ravenhill (London) asked for directions on the subject of the

avoidance or disposal of household dust. How should floors be covered if carpets are undesirable, yet owing to the spaces between floor boards dust first accumulates and, under certain conditions, rises again into the rooms? If gas stoves are employed for cooking and heating purposes, what substitute for a coal range can be employed for the daily destruction of organic house refuse? In what way can rugs or dusters be freed of their dusty accumulation if shaking out of doors be vetoed on account of public health?

MR. DOUGLAS ARCHIBALD (London) said that dust was not always prejudicial. In India, for example, in the Punjab and North-West Provinces, where it was estimated that the finest dust extended to as much as 10,000 feet above the earth, the climate was much healthier than in Eastern Bengal, where the air appeared to be practically dustless. He thought the regular observation of the proportions of dust in the air, such as had been done to some extent by Mr. Aitken and others, by means of the somewhat complex instrument invented by Mr. Aitken, ought to be included in the category of meteorological statistics. He had made some rough observations himself, which shewed that about 100 ft. above the surface the proportion was about half that a few feet from the ground.

DR. BOOBBYER (Nottingham), in reply, said that the congested life of modern cities called for the exercise of special care in the directions he had indicated, if we would keep their inhabitants reasonably free from the risk of accidental infection of various kinds. In answer to Dr. Bostock Hill, he would say that it was a matter of indifference to him whether or not the motorist suffered inconvenience from the nuisance of his own raising. What he (Dr. Boobbyer) objected to was, that the motorist in the pursuit of his hobby caused an insufferable nuisance to the public, the majority of whom were not motorists and had no sympathy with them. He (Dr. Boobbyer) would advise Miss Ravenhill (though only as a "*pis aller*") to deal with specially defective floors by covering them with linoleum fastened down with glue. For the cleansing of mats, carpets, and other like articles, he advocated the establishment of municipal cleansing depots, with a system of vans to collect and return the articles. He had recommended the burning of organic refuse in a domestic fire, of course, only where there was a domestic fire to burn it in. He agreed that public scavenging was for the most part very imperfectly done. He agreed with Dr. Meredith Young in thinking that summer dust, especially the summer dust of towns, was specially liable to produce inflammatory troubles of the eyes and air-passages. Mr. Archibald had said that dust did good as well as harm. That might be, but there could be no doubt that in the case at any rate of such dust as he (Dr. Boobbyer) had referred to the harm was immeasurably preponderant.

THE ANCIENT WATER SUPPLIES OF BRISTOL.

By THOMAS LOWTHER.

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ABSTRACT.

BRISTOL may be said to hold a unique position as regards her ancient water supplies, and in addition to their vast importance, they are full of interest, especially to the Bristolian community. It is also much to be questioned if there are any towns in the United Kingdom that possess so many supplies as ancient or of such magnitude.

Bristol can also boast of having hot springs, from which the district of Hotwells takes its name. Although not so high in temperature, the waters possess similar properties to those of the hot springs at Bath. Bristol is also noted as having other springs most famous for their alleged curative properties.

Some of the ancient supplies of Bristol date back to the middle ages, and were, no doubt, first utilized by the friars and monks of that period.

These ancient settlers may have made the question of water supply a part of their religious ceremonies. The cost and labour involved in the completion of these works, in those primitive times, must have been enormous, necessitating the construction of large conduits, subterranean passages, and the laying of lead pipes some considerable distances.

Originally there were seven ancient water supplies to this city, distributed over different areas, each parish supplying its own religious houses first. Documentary evidence, however, proves that any surplus water not required for themselves was allowed, under certain conditions, to be taken by the adjoining parishioners. Disputes appear to have occasionally arisen as to right of usage, but there was never a military struggle for the possession of the springs, such as we read of in Biblical history.

On suppression of the monasteries the maintenance of these ancient

supplies was vested in the various churchwardens, who charged a tax on the owners of properties using the supplies; but on the foundation of the Bristol Water Works Company in 1846, these taxes were suppressed. Notwithstanding that legacies were left for the up-keep of some of these supplies, they have been neglected in recent years, and consequently not much used for domestic or other purposes.

During the water famine at Bristol in 1864 these ancient supplies were again fully utilized, and were augmented by the Corporation fixing pumps to some of the old wells in different parts of the town.

REDCLIFF SPRING AND PIPE.

This is considered to be the oldest of these springs. It was originally the property of Lord Robert de Berkeley, who, in 1207, granted to the churchwardens of St. Mary's, Redcliff, the free use of this spring for the good of the parishioners.

This spring is near Gay's farm and cottages, Knowle, rises through the Lias formation, and is about sixteen feet from the surface; it can be approached by a manhole. The water was conveyed originally by two-inch lead pipes through land and many streets, and discharged into a tank at the corner of Redcliff Hill and Colston Parade. The length of conduits and pipes is about one and a half miles.

Originally the water of this spring was abundant in quantity, of excellent purity, and was largely used by the parishioners. St. John's Hospital, Guinea Street, now Camden Terrace, was by arrangement supplied from this source.

ST. JOHN'S SPRING AND PIPE.

This historic and famous supply of water is the property of the churchwardens of St. John's the Baptist, but, by agreement, is now maintained by the corporation.

This supply is obtained by two springs, one on the north-eastern side of Brandon Hill, and the other from the top of Park Street. The springs rise through the Millstone Grit and are approached by manholes and subterranean passages of considerable length, well constructed and arched over; these were originally open conduits. The water is conveyed by two-inch lead pipes, under many houses and streets, discharging into a tank at the end of St. John's Church, Nelson Street. The length of conduits and pipes is about three-quarters of a mile.

The source of supply is at the present time abundant in quantity and fairly pure. It is well suited for domestic or other purposes.

All Hallows and All Saints Spring.

This spring rises from the New Red sandstone in an orchard originally belonging to the Priory of St. James, on the south-eastern side of Kingsdown and Maudlin Street.

It was first utilised in the thirteenth century, and in the fourteenth century the free use of it was granted to the parishioners of All Saints by the Grand Prior and Proctor of St. James.

The spring is approached by manholes and subterranean passages, similar in every respect to St. John's spring. The water is conveyed through many streets and under houses by two-inch lead pipes to a tank in All Saints' Lane, near All Saints' Church. The length of conduits and pipes is about three-quarters of a mile.

This source of supply was originally abundant in quantity and of fair purity, but is not now much used for domestic purposes.

Jacob's Wells Springs.

There are two springs, both on the north-eastern side of Jacob's Wells, rising through the Millstone Grit.

These springs were undoubtedly utilised in the thirteenth century by the monks of St. Augustine's, now the Cathedral, perhaps before or during the reign of Edward III. They were specially visited by the Bishop of Worcester in 1320, and some mention is made of Woodwell Lake, which originally received the overflow from these springs.

The two springs were separate properties, one belonged to the Corporation and the other to the Dean and Chapter, and they underwent many changes, especially during the Cromwellian period. The Bishop's palace and adjoining buildings were converted into a malthouse and brewery.

The water was conveyed originally by two lead pipes, and discharged into two storage tanks, one near the Cathedral and the other in Unity Street; the latter also supplied the old Grammar School and Gaunt's Hospital, now the Redmaids School.

These springs supplied all the houses in the area of St. Augustine's. The water was always abundant in quantity, of exceptional purity, and well suited for all purposes. Their use at the present time is confined to supplying the new baths and wash-house in Jacob's Wells.

The length of conduit and pipe is about a mile.

Boiling Wells Springs.

There are really two springs which rise through the New Red sandstone

near Ashley Hill station, where the waters rise up under hydraulic pressure, and are called the Boiling Wells.

These springs were first utilised in the fourteenth century, and taken possession of in the sixteenth century by the Corporation, who keep them in repair.

One of them supplies the Quay head tap at the corner of St. Stephen Street and Broad Quay where the storage tank is situated. The other is now used by the Bristol United Brewery Company at their brewery in St. Paul's.

In the early days these springs were extensively used although the water was extremely hard; it was always fairly pure and abundant. Its use at the present time is principally confined to shipping and to premises of the warehouse class.

The two lead pipes passed through several streets and under many houses to the storage tank. The length of pipe, which at the present time is composed of 3-in. lead and iron pipes, is about two miles.

During the water famine at Bristol in 1864 a special grant was given to the Water Works Company to use these springs; the water was pumped, and supplied the district of Montpelier.

TEMPLE CONDUIT OR RAVEN'S WELL AND PIPE.

This spring rises through the Lias at Pylle Hill, Totterdown, and was originally the property of Sir John de Gourney, Lord of Knowle, who in 1566 granted to the inhabitants of the parish of Temple the right of conveying the water by conduits and pipes close to a friary of Hermit Brothers, Temple Gate. The water was afterwards conveyed to a tank near Temple Church tower, which also at one time supplied the present historic Neptune Fountain when it stood near the church.

The spring is approached by manholes and subterranean passages. The conduit is partly constructed of stone, earthenware, iron, and lead pipes which pass under many houses and streets, and is about a mile long.

The water originally was very pure, abundant, and well suited for all purposes; but, like all the other ancient supplies, the good qualities have been much affected by the construction of new streets, sewers and drains. This water at the present time is only used for trade purposes.

ST. THOMAS' PIPE.

The supply to this pipe is really an overflow from the tank at Redcliff Church, which was granted in the fifteenth century to the churchwardens

of St. Thomas, under stringent conditions and by the paying of a tax of twelve pence per year.

The lead pipe is about half a mile in length, and the tap, which was surmounted by a fine canopy, originally stood in the middle of Thomas Street. It was afterwards removed and two taps fixed in Thomas Lane, one of which was also removed recently; the supply of water at present is very limited in amount.

St. Nicholas' Pipe.

This tap and canopy was on the north-western corner of Bristol Bridge. The water was famous for its good qualities, and extensively used for shipping. The tap was removed in 1762, when the old bridge, with its pile of houses, and old St. Nicholas' Church and gate were taken down.

Famous Springs.

Bristol was noted for its famous springs, and the more important of them are St. Vincent's Hot Springs, near Cumberland Basin; Zion Spring, Clifton Rock Hotel, Zion Hill; Richmond Spring, Richmond Spring Hotel, Gordon Road; Mother Pugsley's Well, on the north-eastern side of Kingsdown. These, in addition to their historical pedigree, possessed excellent curative properties, and were extensively used in the early days for all purposes.

Early Water Works.

The earliest mention of a water works company being established in Bristol was in 1695, and in 1696 the company received the Royal assent to construct works, lay mains, and charge a water-rate on all houses using the water.

The source of supply was at Hanham Mills. The water was conveyed to Crew's Hole, and pumped by a very primitive engine to a tank on Lawrence Hill. It was then conveyed to the city by pipes of elm. Some of these pipes have recently been found, and a specimen is in one of the Municipal authority's depots.

These works were completed at a cost of £7,000, but were abolished in 1700.

The present Bristol Water Works were founded in 1846, and great praise is due to the Company for its enterprise.

ON THE ABSORPTION OF GASES, VAPOURS, AND SUBSTANCES FROM SOLUTION BY SOLIDS.

By MORRIS W. TRAVERS, D.Sc., F.R.S.,

Professor of Chemistry at University College, Bristol.

THE idea of the formation of a solution, a homogeneous mixture, when the solvent is a liquid, is sufficiently familiar to require no explanation, but the extension of the principle to the case of solids is of recent introduction, and the term "solid solution" may seem to convey contradictory notions. There are, however, many well-known cases in which substances, mixed when they are molten, solidify without separation of the components, and form a homogeneous solid mass; and as homogeneity is the one criterion of solution, there is no reason to confine the application of it to liquids.

It is well known that charcoal will absorb gases in large quantities, and that such substances as wool and cotton will absorb moisture, and of these phenomena there are two possible explanations, which have been considered respectively by Professor Trouton of University College, London, and by myself in papers read recently before the Royal Society. Professor Trouton considers that the gas or moisture is condensed on the surface of the substance, and as the area of the surface, in the case of such substances as those under consideration, is obviously considerable for a comparatively small mass of the substance, and as theory indicates that surface condensation is possible in such cases, there is some ground for his conclusions. I, on the contrary, hold that the gas or vapour simply dissolves in the solid material just as oxygen dissolves in water, but for reasons which will be considered later, the simple law which applies to the latter can be modified in the case of solid solutions.

When a gas like oxygen dissolves in water, the quantity of it which passes into solution at any definite temperature increases directly as the pressure, so that if we plot on a diagram the quantity of gas dissolved

against the pressure we obtain a straight line. This is Henry's law, which may be expressed by the formula,

$$p/c = \text{Constant},$$

where p is the pressure exerted by the gas and c is the concentration of it in the liquid, that is to say, the quantity of it which is present in unit volume, or in unit mass of the liquid.

Suppose that we now consider the absorption of a gas like carbon dioxide by charcoal. We find that if we plot on a diagram the pressure against the quantities of gas absorbed at a series of constant temperatures, we obtain not a series of straight lines, but a series of curves. These curves are represented by the formula,

$$\log. p/c = \text{Constant, or } n\sqrt{p/c} = \text{Constant},$$

and the curve corresponding to the highest temperature corresponds most nearly to a straight line, so that the index n in the second form of the equation tends to become unity at high temperatures; that is, it increases as the temperature decreases.

In the paper already referred to I have put forward, as an explanation of the difference between the laws relating to the absorption of gases and vapours by liquids and solids respectively, the suggestion that while in the former case complete homogeneity of the liquid is ensured by convection and mechanical stirring, in the latter case the gas spreads through the solid by diffusion only. It may be then that diffusion in some way affects the ultimate condition of equilibrium, and that when equilibrium is established the condition is such that the surface layers of the solid hold in solution more of the gas than does the material at a distance below the surface. In other words, the concentration of the gas dissolved in the solid decreases logarithmically with the distance below the surface.

As was already stated the value of n in the second form of the equation increases with decrease of temperature for any particular gas, and for a definite temperature, for a series of gases, varies in the same direction as their densities, or perhaps is more directly connected with their critical or boiling points. When n is large the curve appears to resolve itself into a vertical and a horizontal portion. The result of this is that for gases like ammonia or sulphur dioxide at the normal temperature, or for the more permanent gases at lower temperatures, a substance like charcoal seems capable of becoming saturated with a gas at a very low pressure, and will not take up much more of it, even if the pressure is greatly increased.

This is the explanation of the deodorising property of charcoal. The

vapours which are given off from decaying organic matter probably consist of chemical compounds of no very simple character, and consequently having a considerable density. The absorption curve of such substances by charcoal is represented by a formula already given, and at ordinary temperatures the value of n is large. Hence, though the odoriferous vapours may be present in the air to only a very small extent, they are completely absorbed by the charcoal, the latter appearing suddenly to become saturated.

The absorption of moisture by textile materials furnishes an interesting example of the same principle. If such a substance is introduced into a bulb, maintained at constant temperature, and connected with a manometer for measuring the pressure, and after completely removing all traces of air and moisture, successive quantities of water are introduced, the relationship between the quantity of water absorbed and the pressure exerted by the vapour can be determined. The results of some experiments I have carried out indicate that the curves are really of the same form as those which represent the absorption of gases by charcoal. They show very clearly that the absorptive power of wool for moisture is much greater than that of cotton; thus at a pressure of 2·3 millimetres of mercury, which is equal to half the saturation pressure of water a 0°, wool will absorb almost exactly twice as much water as cotton.

Owing to experimental difficulties the absorption curves were not investigated at very high pressures, but Trouton's investigations, which have already been referred to, indicate that they ultimately bend to the right and become horizontal when the pressure reaches the saturation pressure at the temperature of the experiment. In my opinion the slight curvature to the right, which Trouton's researches indicate, is due to surface condensation, which sets in only when the material is nearly saturated; Trouton, however, attributes the whole phenomenon of absorption to surface condensation.

According to my view of the case, when a textile material, previously dried, is brought into a moist atmosphere, such as is produced near the surface of the body, it absorbs the water vapour, forming a "solid solution" of water in the material of the fibre. When, however, the concentration of the water in the material reaches a certain value, dependent on the temperature, and corresponding to the concentration which is in equilibrium with water at the saturation pressure, liquid water separates on the surface of the fibres and the material becomes wet. Since the absorptive power of wool is greater than that of cotton at the same temperature, it is obvious that it will take longer to become saturated, though at the same

time it is necessary to point out that in practice one is not dealing with a static condition.

Some interesting points arise out of the discussion of the nature of the substances which possess absorptive power. In the first place they appear to be invariably noncrystalline or amorphous, and perhaps it will be worth while to explain the exact significance of these terms. When a liquid is cooled it either changes into a crystalline solid, the change involving a sudden expansion or contraction, and being accompanied by marked changes in the physical properties of the substance, or it merely becomes more and more viscous and changes with *complete continuity of properties* into what is apparently an amorphous solid or a glass. Hence, while the formation of a crystalline solid involves a definite change of state, an amorphous substance or a glass is still in the liquid state, but has become so viscous as to have assumed some of the properties which we are accustomed to associate with the solid state. Amorphous "*solids*," like charcoal and wool, must then be classed as supercooled liquids, and perhaps this may help us to realise how they play the part of solvents in the phenomena we have considered.

The absorption of substances from solution by such bodies as charcoal, textile materials, &c., which is commonly referred to as "adsorption," is a phenomenon analogous to that of the absorption of gas by them. The absorption of dyestuffs from solutions by wool and other fabrics follows a law which is identical with that stated, which may be written,

$$n\sqrt{c'}/c = \text{Constant},$$

where c' is the concentration of the dye in the solution (liquid), and c is the concentration in the material of the fibre (solid solution). Similarly, charcoal absorbs substances from solution, and if the substance is of high molecular weight the charcoal will behave as towards gases of high density, apparently absorbing the whole of the substance from the solution, even when it is present in very small quantity, but at the same time appearing suddenly to become saturated with it. Thus, we can account for the absorption of the colouring matter of sugar, and other solutions, the colouring matter probably consisting of compounds of complex character and of high molecular weight.

Bearing on this point, there have been some important questions raised in connection with the function of the coke in the process of purifying sewage. The greater part of the nitrogen in the sewage is present as ammonia or ammonium salts, and it is held by certain chemists that the process of oxidation of this ammonia involves its absorption by

the coke. This question is discussed and combated by Miss H. Chick in a paper in the Proceedings of the Royal Society (*77*, 241).

Through the absorptive insolvent power of amorphous charcoal, obtained by calcining organic substances at a low temperature, it loses that power to a remarkable extent if it is strongly heated, and hard coke, obtained by distilling coal at a high temperature, has very little absorptive power. This is probably due to the fact that the amorphous carbon is partly converted into crystalline graphitic carbon. In any case, if absorption were to take place, the ammonia would pass into the material of the carbon, and would not remain condensed on the surface, and in this condition would rather be removed from the sphere of bacterial action than the reverse.

Were I more closely acquainted with the problems of sanitary science, I might probably be able to bring forward more interesting examples to illustrate the principle I have discussed in this paper. Standing, however, on one side of the line along which pure science and technology meet, I am content to leave the application of this principle to those to whom the work more properly belongs.

THE ORGANIC COLLOIDS OF SEWAGE.

By J. H. JOHNSTON, M.Sc.

(MEMBER.)

IT has been generally considered that the reduction of the organic matter in a state of solution which takes place in a contact bed or in a percolating filter is produced by bacteriological action while the sewage is passing through it, so that the organic matter in the effluent represents the organic matter in the influent less what has been changed by bacteriological action.

In any purification process in which the stages are sharply defined, the gradation in opalescence of the liquid is well marked. This is particularly noticeable in the effluents from the triple-contact beds at Hampton-on-Thames, the opalescence reaching vanishing point in the third contact effluent. The occasions when the clearest effluents are obtained are always those on which the surface filtering layer of the bed yielding them has become filled with a copious deposit and requires cleaning; after this deposit has been removed the earliest effluents are always more opalescent than usual, becoming less so as the normal state of the bed is reached. Hence it appeared as if a great part of the purification consisted in the removal of the opalescence, which seemed likely to be of an organic colloidal character. It was therefore determined to submit sewage to dialysis to estimate the amount of organic colloids contained in it. During the progress of this investigation papers were published by Biltz and Kröhnke (Berichte, xxxvii. 1745) and by Fowler and Ardern (J. Soc. Chem. Ind. xxiv. 483) giving results of the dialysis of sewage.

The apparatus used has been a circular glass dialyser with parchment bottom, suspended in distilled water. The sample was filtered through paper before being introduced into the dialyser and was sterilised by the addition of sulphuric acid. The volume of the sample taken was 50 c.c. and of the distilled water 500 c.c. which was renewed during the dialysis. At the end of six days the dialysis was stopped, as it was found that no further decrease of the organic matter occurred with a longer period.

An estimation of the albuminoid nitrogen yielded by the residue in the dialyser by the alkaline permanganate method was taken as the measure of the organic colloids in the sample.

Ordinary domestic sewage with a chlorine content of about 20 parts per 100,000 was used. Filtered samples of this sewage gave the results shown in Table I.

TABLE I.

Albuminoid Nitrogen in parts per 100,000.

Before Dialysis.	After Dialysis.
·60	·30
·39	·19
·42	·18
·41	·13
·33	·14
·38	·16
·86	·43
·50	·33
·51	·34
·40	·25
·62	·39
·60	·23
·49	·32
·27	·14
Average ·48	·25

TABLE II.

Albuminoid Nitrogen in parts per 100,000.

Without Glass Beads.	With Glass Beads.
·60	·32
·60	·48
·71	·61
·46	·40
·33	·31
·33	·33
·39	·29
·50	·46
·51	·49
·40	·36
·62	.53
Average ·50	·42

TABLE III.

Albuminoid Nitrogen in parts per 100,000.

Before Dialysis.	After Dialysis.
·48	·13
·29	·13
·41	·16
·40	·13
·31	·13
·33	·11
·86	·43
·46	·20
·49	·21
·53	·23
·27	·11
Average ·44	·18

The results in Table I. shew that 52 per cent. of the albuminoid nitrogen was in the colloidal state.

In the filtration observations it was noticed that the opalescence tended to decrease on repeated filtration, particularly if the sample was refiltered through the same filter. It was thought that this removal of colloidal matter might be effected by presenting a large surface to the liquid. For this purpose a bottle containing the filtered sample was filled with glass beads and allowed to stand for four hours. The sample was then poured off, filtered, and analysed. For comparison another portion of the original sample was allowed to stand during the same period of four hours, again filtered, and analysed. The results obtained are shown in Table II.

These results shew that 16 per cent. of the albuminoid matter was removed by the action of the glass beads. There is considerable divergence from the average among some of the samples, due to the difference in the stability of the colloids in the different samples, for if the colloidal phase is a stable one, then it is not so amenable to surface action.

The figures in the first column measure the organic matter left in the sample after the period of standing in the bottle and the double filtration: the latter removes some of the colloids in an unstable phase, and some also are further removed by the sides of the bottle itself. The figure 16 per cent. therefore gives the amount of organic matter which has been removed by the surface action of the glass beads, over and above the amount which has been removed by the other surface actions, which are alike in the two cases.

The liquid, which had undergone the surface action of the glass beads, was also submitted to dialysis with the results shown in Table III.

These results indicate a colloidal content of 41 per cent. Comparing this result with the previous result for the amount of colloids in sewage in its ordinary condition there is a reduction of the colloids from 52 to 41 per cent., which has been brought about by submitting the sewage to surface action. It might have been thought that this reduction of 11 per cent. should have been equal to the reduction of 16 per cent. brought about by the glass beads, but the experiments of Sonstadt (J.C.S. lxxxix., 339) show that glass beads also exert a surface-action on crystalloid matter in solution.

Different explanations have been given of the removal of organic matter which takes place in a filter-bed. Mills (State Board of Health, Massachusetts, 1890, Purification of Sewage and Water, pp. 578, 586) in discussing experiments with gravel stones, states that the slow movement of sewage in thin films in contact with air over the surface of the stones removed 97 per cent. of the nitrogenous organic matter, a large part of which was in solution, and enabled it to be oxidised. In another experiment he states that the albuminoid nitrogen, although in solution, was in large part stored in the sand, for after allowing the bed to drain and then resuming filtration, the amount of nitrogen which came away, principally as nitrates, was 50 per cent. more than was applied. Although Mills says simply that the albuminoid nitrogen was in solution, it is evident that it was in colloidal solution, removed as a hydrogel by the stones and sand, and subsequently hydrolysed and nitrified. Dibdin (Purification of Sewage and Water, p. 62) in summarising the work accomplished by the one acre coke-breeze filter at Barking, states that it oxidised the whole of the organic suspended matter applied to it, and also the whole of the dissolved organic matter which it removed from solution. Harding and Harrison (City of Leeds Report on Experiments in Sewage Disposal, p. 101) found that in a percolating bed, in which the time of passage of the sewage was three minutes, about two-thirds of the

albuminoid nitrogen was removed, and they draw attention to the remarkable rapidity with which the chemical changes were brought about.

Another explanation, first put forward by Dunbar (Vierteljahrsschr. ger. Med. u. öffentl. Sanitätswesen, 3 Folge, xix. Suppl.-Heft. See also Kattein and Lübbert, Gesundheits-Ing., 1903, No. 25) is that the reduction of the organic matter is due to absorption, the bacterial layer on the material of the bed combining with the organic matter to form an absorption compound. This process Biltz and Kröhnke (*loc. cit.*), who were the first to recognise the colloidal character of the putrefactive material, prefer to call adsorption. They stated that the bacterial coating produced a specific purification effect, which they have since explained as not a vital process but as due to the bacterial coating acting simply as an organic surface.

These experiments, however, show that the mere presence of surfaces without any bacterial coating, effects the removal of the colloidal matter. The natural tendency of the colloids to flocculation, described by Jones and Travis (Proc. Inst. C. E., 1905, 6), proceeds at a much faster rate when they are in contact with surfaces. The removal of the colloidal matter from sewage by a filter-bed takes place mainly in virtue of the surface action of the material of the bed; the surface producing the action may be either the surface of the material itself or the surface of the material coated with any colloidal or other matter already deposited on it. The rate at which the colloidal matter is removed depends, at all times, upon the degree of instability of the colloidal solution and the intimacy of the surface contact. The colloidal matter, after removal from the liquid, is subject to biological action in the filter-bed, whereby it is reduced in amount and changed in character, and the portion left after this action is partly washed out of the bed by the liquid and partly retained in the bed.

A knowledge of the fact that about half the dissolved organic matter in domestic sewage is in colloidal solution, and a recognition of the physical laws to which colloidal solutions are subject, will have an important influence on the design and working of sewage purification systems in the future.

Mr. Arthur J. Martin (Westminster) said that the paper was a most important one, including as it did a new view of the work involved in the purification of sewage. Hitherto they had been accustomed to take it, speaking broadly, that this work was twofold—that they had first to remove the

solid matter and secondly to purify the dissolved polluting matter. Mr. Johnston and his colleagues now told them that they had a third task to perform, and a class of matter to deal with which did not fall into either of these two categories. A question had been raised as to whether this matter was truly colloidal; but however that might be, there was no doubt that a filter might be clogged to a very serious extent by an apparently clear effluent. It therefore became necessary to provide means for intercepting this so-called colloidal matter, and it appeared that this might best be done by providing surfaces upon which it might be deposited, so as to prevent this deposit from taking place upon the particles of the filter proper. These surfaces might either be constantly submerged, as in Dr. Travis's hydrolysing chamber, or they might be alternately wetted and dried, as in Mr. Dibdin's contact bed. In either case it seemed desirable that they should be so arranged that they might readily be cleaned whenever required.

PURE BEER.

By JOSEPH W. LOVIBOND.

WITH our present imperfect knowledge of the changes which take place in the alcohols and soluble albuminoids during the maturation of beer, after the first fermentation is finished, we cannot deal exhaustively with the subject; this paper is, in fact, but little more than an attempt to define the term, accompanied by some personal views based on more years of practical work than I care to emunerate. I must ask you to bear in mind that the conditions of producing an ideal pure beer are in some ways not applicable to beers brewed at popular prices for quick consumption.

But little idea of the importance of the changes brought about by the second fermentation can be obtained from the proportion of the new constituents to the whole, they being mainly perceptible by flavour and bouquet, and appear to be analagous to the changes which take place during the maturation of wines, and which, by their subtle differences, influence values ranging from pence to pounds. The range of values is naturally not so wide in beers but yet of sufficient importance as to be a considerable factor in value differences, and I cannot but think that there is still room for an ideal pure beer to rank in some measure with the higher classes of wines and spirits.

Alcoholic beverages have supplied a want felt by all peoples within historical times; in hot climates the necessary saccharines are the direct product of fruits, which also provide in a natural manner the necessary ferments to convert the saccharines into alcohol; these may be generally classed as wines. In temperate climates where the saccharines are derived from starches of cereals or roots the ferment for converting into alcohol is artificially added, and the beverages classed under the general term of beer. In colder climates where nature demands more potent beverages, the alcohol of wine and beer is concentrated by distillation under the general name of spirit, concerning the specific definition of which there is just now some difference of opinion. I mention these three divisions because they are separate competitors for public support, and in

a measure replace each other according to their merit as beverages, and so affect their several prosperity as industries.

The term "pure beer," is at present in an unsettled condition, under the excise regulations, a wide range of starches and sugars are now sanctioned, and should a definition of the term be forced to an issue, probably it would be held to comprise all legal material. There is, however, a considerable section of the public who consider that the term should apply to beer brewed from malt and hops only. To avoid controversy it may be suggested that the term "pure beer" should be generic for all legal material and become specific by adding the nature of the material used to the term itself, such as "pure malt and hop beer," "pure sugar beer," etc., in the case of mixed material the percentage of each may be added.

The percentage statement may at first sight appear an unnecessary refinement, but it is beyond question that in unkindly seasons when the barleys are imperfectly matured, the addition of a non-nitrogenous saccharine is a partial compensation for the immature barley. I recollect paying particular attention to this one such season, and then arrived at the opinion that improvement held good in that year up to 8 per cent. of added saccharine, but more than this became a dilutent of the natural flavour of the barley malt.

A beer may be brewed from malt and hops alone and still be far removed from an ideal pure beer, as conditions may arise during brewing which would not only prevent its reaching the highest excellence, but may convert it into an ill-flavoured beverage.

One of these degrading influences is the presence of a variety of micro-organisms other than yeast. All of these are more or less inimical to healthy fermentation, each variety producing its own specific ill-flavour, some being very ill-flavoured indeed. The researches of that prince of original investigators, Pasteur, has, however, reduced this evil to a minimum by making their presence easy of detection by means of the microscope.

Probably the most important factors in developing the properties of fine flavour and condition, which are essentials in an ideal pure beer, are derived from the slow decomposition of the soluble albuminoids in the presence of alcohol during the second fermentation. Their removal by extreme low temperatures, filtration, or other artificial means has a deteriorating effect on the maturing process, preventing the beer from attaining the highest possible excellence, although their removal may still produce an agreeable beverage. I do not know if the nature of the

products which determine flavour and bouquet are fully understood by advanced men of science; their presence is, however, perceptible to the palate, and is associated with a peculiar brilliancy which no filtered beer I have yet seen can equal.

The production of an ideal pure beer is really dependent on two factors. The first relates to the elements of composition, and may be met by a declaration of the materials used. The second, comprising flavour and condition, is more complex, and for it we have no standard of comparison other than individual opinion, and the judgment of the public. The latter I consider to be both sound and appreciative.

The illustrating tables and chart which were shown comprised a series of colour measurements of a pale ale during fermentation, and are an attempt to trace the development of that peculiar brilliancy already mentioned as associated with fine flavour.

The measurements were made periodically during and after the first fermentation. They were filtered bright when necessary. The changes of colour and light indicated are therefore not caused by matter in suspension, but by matter in solution.

The tables show that in the early stages of fermentation there is present an element of light absorption, the absorptive energy of which is quantitatively represented by the numerical unit values under the columns headed black; this decreases and disappears as the fermentation proceeds, and is replaced by elements having a greater power of light transmission, the unit values of which are recorded under the columns headed light. I have long associated this increase of light transmission with the development of fine flavour, and consider that there is a relation between them.

There is still one considerable factor which certainly has a deteriorating effect in beer, that is the use of antiseptics; they are not really necessary in a well-regulated brewery. I consider them almost as adulterants, and when they are used would make their declaration obligatory.

ON THE PREVENTION OF THE GROWTH OF ALGÆ IN WATER SUPPLIES.

By SAMUEL RIDEAL, D.Sc.Lond., F.I.C., (FELLOW),

And RONALD ORCHARD.

THE fouling of reservoirs and conduits in water works by various growths is a problem that has frequently to be dealt with by the water engineer, and, although it has not attracted general attention in this country, in America, and especially in tropical climates, this contamination of large volumes of water is often a serious matter, and on the continent several State commissions have had to deal with this subject. The contamination frequently consists of one, or several, of the very numerous algæ, many of which, besides causing the clogging of valves, etc., and an unsightly appearance, are capable of imparting disagreeable odours and tastes. Trials have been made to destroy or inhibit the growth of the plants by the addition of a minute quantity of a germicidal substance to the water. Various reagents have been employed in the laboratory to prevent the dense, unsightly growths occurring in the glass outer jackets of Liebig condensers, which we have found to consist largely of desmids and other unicellular algæ allied to *protococcus*. These are inhibited for a short time by introducing strips of bright metallic copper; solid naphthalene gives better results, retarding all growth for a long period. Some forms of algæ appear to flourish especially in calcareous waters, and also in those containing quantities of free CO_2; on the other hand we prevented the growth of conferva and desmids in tap water with this gas.

On a large scale metallic salts such as those of iron or copper have been used. The employment of the latter in the form of crystallised copper sulphate has met with a fair amount of success, the poisonous copper being subsequently precipitated as a basic salt, the coagulating effect of which often renders the finished water very clear and bright.

In the early experiments in this direction by Dr. G. T. Moore, of the United States Agricultural Department, the quantity of crystallised sulphate required varied from one part per million to one per fifty millions,

while some waters did not appear to be amenable to the copper treatment. He found that the worst tastes and odours are most susceptible. In conjunction with Kellerman, he recommends the following dilutions per one part of copper sulphate, for the destruction of each organism named:—

Clathrocystis	...	...	8,000,000
Cœlospherium	...	...	3,000,000
Microcystis	...	...	1,000,000
Oscillatoriæ	...	...	5,000,000

However, we have found that the growth of a conferva (a variety of *spirogyra*) was inhibited, but by no means entirely destroyed by the addition of one part per million, in an English lake water.

The time required for the subsequent natural precipitation of the copper varies with different waters from some twenty-four hours to twenty days. A soft South African water recently examined in the laboratory, did not become clear even in the latter time. This is a serious objection, especially when it is remembered that the coagulum rapidly clogs filters. In some instances, a fractional treatment would be more economical. However, the cost of material is in any case insignificant; taking copper sulphate at £28 per ton, the amount for treating a million gallons of water with one part would cost 2s. 6d. The chief outlay is always incurred in labour, storage, and the systematic testing of the product for freedom from copper. In a former paper,* one of us, in conjunction with Dr. Baines, pointed out that the minute amount of copper required to destroy algæ would not be harmful to man. Up to last year the Massachusetts Board had declined to sanction employment of copper salts for drinking-waters.

In the addition of the germicide to large reservoirs it must be remembered that the solution will diffuse downward and horizontally, any upward movement being very slow. At Newport (Mon.), reservoirs were successfully treated by trailing bags of copper sulphate across the surface of the water, the rate of solution being controlled by the thickness of the material inclosing the salt. Similar experiments at Gloucester Waterworks have been successful in removing the spring growth from the reservoir. Trials by the Massachusetts State Board of Health in 1903 and 1904 with copper sulphate, gave conflicting results.

A proprietary article, containing "available chlorine," has been advertised for removing the green growth and slime in swimming baths, but we are not aware that any attempt has hitherto been made to employ a solution of chlorine or its oxides for the prevention of these growths in

* *Journ.*, *R. San. Inst.*, 1904, Vol. XXV., No. 3.

potable waters. Their adoption, however, for this purpose is indicated by their recent successful application, in the form of an electrolytic chlorine solution, for the sterilization of effluents, and certain laboratory experiments which we have made are very promising. The advantages over the use of metallic salts, such as those of copper, are obvious. Even if the treated water was distributed with its full amount of available chlorine, it would not be harmful in the high dilution employed, but the removal of the chlorine is rapid and very certain, so that the only permanent addition to the water is a minute quantity of common salt. Possibly the staple perchlorate is formed as a final bye-product, but the amount is so infinitesimal that it cannot be detected. The employment of chlorine alone does not in any way clarify turbid water, but there is no added danger of the subsequent clogging of filters. As with copper sulphate the actual cost of material is low, and electrolytic plants are now on the market which require but little attention when once adjusted for a specified output.

In the laboratory experiments already alluded to, an electrolytic chlorine solution obtained from the Digby hypochlorite plant has been employed; this solution, besides having the advantage of cheapness, contains but little undecomposed sodium chloride, and consequently the final addition of chloride to the treated water is very small.

In considering the treatment of water with electrolytic chlorine, first of all the immediate chlorine consumed figure must be determined, that is to say, the available chlorine at once taken up by the organic matter of the water, since obviously in order to successfully inhibit growth the addition of the chlorine should be equal to or in excess of this amount, although in one of our experiments an addition of only half the available Cl immediately consumed (0·17 parts per million) decidedly retarded growth in tap water.

The value can be approximately calculated from the oxygen consumed figure, but should be determined directly. The available chlorine consumed in five minutes by drinking waters usually falls below 0·5 parts per million; in two London tap waters it was found to be 0·345 and 0·33 parts and with a lake water 1 per million.

From experiments made on a large scale at Guildford with tap water purposely infected, it was found that the addition of 0·6 parts per million of available chlorine destroyed objectionable bacteria of the coli class in less than one hour, and that the residual available chlorine completely disappeared after some twenty hours' exposure in the large tanks.

In our recent laboratory experiments, quantities of water drawn from the lake in St. James' Park, were treated with varying amounts of an

electrolytic chlorine solution and of copper sulphate. These, together with untreated samples of the water, were kept under the most favourable conditions for the growth of algæ. Of course the growth in all cases was dependent upon the amount of sunlight from day to day, and the best results were obtained in colourless glass vessels with partial aëration. Green glass and to a lesser extent great aëration decidedly retard growth. Periodical examinations were made, and when growth was apparent it was examined under the microscope for identification. After some four to seven days all the untreated controls showed vigorous, green, filamentous growths, starting from the bottom of the vessels, which, after a longer period, permeated the whole volume of the liquid. They then became less definite in character and obviously of a mixed nature, owing to the later development of the numerous other algæ present in the lake water. Microscopical examination revealed that the bulk of the growth in the untreated water at first consisted of two varieties of a conferva—*spirogyra*. Subsequently numerous other *algæ*, green desmids, and diatoms, especially *asterionella*, developed. For example, the following entry in the laboratory note-book records an examination of a treated water: "*No. 6.* Available chlorine added 1·2 parts per million, time 31 days. Bright green and brown growth visible. *Microscopic* examination: chiefly desmids present (*raphidium*, *closterium*, *scenedesmus*), many diatoms (*navicula*), a few protozoa (*monas*, motile)." It was found that successful sub-cultures from the lake water experiments could be made into tap water, copious growths being obtained after a week; these were fairly pure owing to the sharp differentiation caused by the available chlorine added in the original lake water experiments, and a further series was made, using the tap water so infected.

As already stated, the immediate chlorine consumed figure of the lake water was 1 part per million, and that of the tap water 0·33; briefly, the conclusions arrived at from these experiments were:—

1. Green growth can be prevented by the use of electrolytic chlorine.

2. The different microscopic plants require varying amounts of chlorine to inhibit their development, confervæ appearing to be most susceptible to treatment. Available chlorine just in excess of that immediately consumed by the water, although disappearing itself in a few hours, inhibited confervoid growth for some weeks. Desmids were found to be slightly more resistant, and, in the experiments, required the addition of some 0·5 parts per million in excess of that immediately consumed by the water. Diatoms appeared to be still more resistant, and required 1 part per million of chlorine in excess.

3. Animalculae, like daphnia and cyclops, are not killed by even larger doses of chlorine, and were found actively motile after a month's treatment with 11 parts per million.

4. The addition of 1 part of copper sulphate per million was not successful with lake water, as it did not clarify, and the green growth was only slightly retarded. The effect was not equal to the use of 1·2 parts (0·2 in excess) of chlorine per million.

5. Under the microscope a distinct bleaching of the coloured algæ was noticed with upwards of 2 parts per million of available chlorine, this cannot occur without strong physiological action. An exception to this occurred in Experiment No. 2 (with the lake water), where the desmid, *ankistrodesmus*, was not bleached by 2·02 parts per million, and after some four weeks' inhibition appeared to be starting fresh growth.

An important factor, the chemical condition of the treated water as representing that distributed for consumption, was also dealt with in these experiments. In all cases the added available chlorine completely disappeared, 1 part per million, added to tap water, could not be detected after five hours, and even in the maximum addition of 11·2 parts per million to the lake water (which is greatly in excess of that required), no available chlorine remained after a few days' sojourn in a partially filled glass vessel, loosely plugged with cotton-wool. In fact, this rapid decomposition of hypochlorites into chloride and oxygen, somewhat militates against their use, as, in practice, the germicide might be removed too quickly, especially by agitation of the water.

The natural chloride, originally present in the lake water, was found to be somewhat high: 14·71 parts per 100,000. The electrolytic chlorine solution contained 0·2 per cent. available chlorine and 3·17 per cent. sodium chloride (this was employed diluted to one tenth with distilled water), so that treatment with 2·2 parts per million of chlorine, which was found to preserve the lake water for upwards of a month, required eleven volumes of the electrolytic solution per 1,000 volumes of water. Theoretically, this increases the total chloride of the water from 14·71 to 16·64. The actual amount found in the treated water was 16·73 parts per 100,000.

Two photographs of cultivations incubated under identical conditions were shown: B showing the growth of conferva in London tap water, and No. 2 showing the absence of growth in the same infected water, after treatment with 0·44 parts per million of available chlorine. Practically the only alteration in the chemical analysis is a reduction of the oxygen consumed figure, and an increase of the chloride from 2·1 to 2·4 parts per 100,000.

A SHORT PROCESS FOR THE EXAMINATION OF BUTTER AND MARGARINE.

By E. RUSSELL, B.Sc., F.I.C.

THE quasi-official method for the analysis of butter and margarine, known as the Wollney Reichirt process, is essential for the final determination of the extent of adulteration in the case of any impure sample of butter, or the determination of an excess of butter in a sample of margarine, but the use of this process is not necessary for the first examination of the fat of butters or margarines, collected under the Food and Drug Acts, as a sufficiently valuable indication of the genuine or suspicious character of a sample of fat may be obtained by the use of the Valenta or the Zeiss butyro-refractometer tests. Again the determination by weight of the moisture in a sample of butter or margarine is not absolutely necessary; as a valuable though somewhat rough indication of the amount is furnished by a volumetric calculation of the fat. In view of the number of samples collected under the Food and Drug Acts in large towns, and the pressure of other work in municipal laboratories, it would be well if some rapid methods for dealing with the large numbers of this class of substance, similar to those methods in use in milk analysis, could be adopted. I have, during the past three years, found the following process the most rapid for differentiating the normal samples of this class from the suspicious, abnormal, or adulterated samples, and I therefore submit it for consideration. A series of samples are taken in order, each being introduced into a numbered Nessler jar, accurately graduated in cc.'s up to 50 cc., and not merely marked at the 50 cc. mark. The butter or margarine is introduced in sufficient quantity to nearly rise to the 50 cc. mark when melted out in the water oven; when the jars have been in the oven for about fifteen minutes, they are transferred to the cup of an ordinary Lefman Beam centrifugator, and centrifugated for two minutes. This causes a complete separation of the fat from the curd salt and water, the total volume of fat can be accurately read, but the line of demarcation between the fat and curd, floating in the water, is not so clear, and the reading is here somewhat rough. The volumetric percentage

of fat is then determined from these two readings. After making these readings, the fat is immediately poured into a dry filter, carefully avoiding the transference of any curd or moisture. The filtration of the warm fat is very rapid after centrifugation, and I find that margarine, which if merely melted out in a beaker and then transferred to a filter, took over an hour to filter, now filters through in a few minutes, so that a convenient amount of clear fat is rapidly obtained, besides the transference of any of the curd or moisture to the filter being entirely avoided. Three cc. of clear fat are mixed with 3 cc. of glacial acetic acid, and warmed until solution is obtained; a thermometer is introduced into the mixture, and the temperature at which turbidity appears is noted, the acetic acid being previously tested against genuine butter-fat, and the Valenta figure for that particular acid and genuine fat obtained. I have found this to vary for good glacial acetic acid between 35°C and 45°C. If a sample of butter gives a figure as low as 30°C or as high as 50°C it is necessary to take a butyro-refractometric observation, but if it falls within the narrower limits the sample may be passed as genuine; in case this is felt to be not conclusive, a butyro-refractometric observation with the fixed butter-scale may be made with every sample with very little more trouble, and with the expenditure of very little time. The two important points in the composition of butter and margarine which engage the attention of the analyst are thus rapidly arrived at, the fat is passed as genuine if it gives a Valenta figure of 35-45, and the moisture is regarded as not exceeding 16 per cent. if the volumetric estimation of the fat is not less than 83-84 per cent. I have in a large number of cases in which this volumetric percentage of fat has been present determined the amount of moisture by weight, and in the large majority of cases I have found about two per cent. less moisture by weight than the difference figure (100 — volumetric fat percentage) only in one or two cases have I found that the figures are nearly identical; this is probably due to the variation in the amount of curd in the particular samples, which also minimises the accuracy of the process and prevents a satisfactory deduction of the weight percentage of the fat from the rough volumetric percentage and the specific gravity, satisfactory determinations of which I have been unable to obtain by this process; yet the fact remains that a satisfactory and useful deduction as to the limit of moisture present can be made. In this way more than a dozen samples may be dealt with in one hour, and the remainder of the fat in the abnormal specimens used for the determination of other and more important constants for fixing the extent of sophistication.

DISINFECTANTS AND ANTISEPTICS.

By O. C. M. DAVIS, B.Sc.

DISINFECTANTS and antiseptics may be described as substances which prevent the spread of infectious diseases.

At the present time it is generally recognised that such diseases are propagated by bacteria or their spores, hence any substance which will bring about the destruction of these organisms will at the same time bring about cessation of infection.

Although bacteria were demonstrated towards the end of the seventeenth, it was not till the latter third of the nineteenth century that the researches of Louis Pasteur laid the foundations of scientific bacteriology. With scientific bacteriology began the study of scientific methods of disinfection.

One of the oldest methods of disinfecting premises is by means of sulphur dioxide, either obtained by burning sulphur where required, or more conveniently at the present day from the liquefied gas, which is produced on a commercial scale for this purpose.

Chloride of lime or, more correctly, chlorinated lime, is too well known to need lengthy comment, its activity depending on its power of liberating nascent oxygen in contact with moisture. An objection to its use is its somewhat unpleasant smell.

Another very common disinfectant, which owes its properties to its power of liberating oxygen, is potassium permanganate. Sodium permanganate also possesses similar properties, and the germicidal power of the calcium compound is stated to be far superior to either of these.

Quite recently there have been placed on the market certain metallic peroxides under the names of "hopogan" and "ectogan," which are capable of yielding nascent oxygen in contact with organic matter, hence possessing properties similar to those of salts of permanganic acid.

More powerful in its action as a germicide is corrosive sublimate, or perchloride of mercury, which has long been used for preparing solutions to sterilise the hands of nurses and surgeons and also their instruments.

Owing to its extremely poisonous properties, coupled with the absence of any smell or colour, its use is naturally somewhat restricted for general purposes. To minimise the risk of danger which may occur in using it, some makers have for a considerable period supplied it in the form of "soloids," which are coloured blue by an innocuous substance. Corrosive sublimate is also used very largely in preparing cotton wool for use as a surgical dressing, and in this case the wool is generally coloured blue for reasons mentioned above.

A somewhat similar substance is mercuric potassium iodide, which is used by many medical men in preference to the perchloride of mercury. Boracic acid is very largely used in the same way as the preceding substances. It possesses the advantage of being practically non-toxic, but its germicidal powers are very inferior.

Coal tar has proved a very fertile source of organic compounds of all descriptions, and in 1834 Runge isolated from it a body which he called carbon-oil acid, or carbolic acid. This was, subsequently, purified by Laurent, and soon became known as phenol. Perhaps no other preparation has attained such popularity as this for both general and special use.

Closely related to phenol in chemical and physiological properties are the three isomeric methyl-phenols or cresols. They also occur in coal tar, and whilst still being powerful bacterides are less toxic than phenol. Of the three, the meta-compound possesses the greatest germ-killing properties, and least toxicity to human beings.

Napthalene, another coal tar product, is also produced on a very large scale, and used for its disinfectant power. Many more or less crude preparations from coal tar are put up as proprietary articles, and their activity generally depends upon the presence of phenol and its homologues. Just as coal tar is obtained by the destructive distillation of coal, so when wood is subjected to similar treatment, many valuable products are obtained. Amongst these is wood tar, a complex substance, serving as a source for the production of phenol, cresol, etc. Besides wood tar, one other product of the distillation of wood may be mentioned, namely, wood spirit, wood naphtha, or more correctly, methyl-alcohol.

From methyl-alcohol is prepared, by careful oxidation, one of the most potent of modern germecides, formaldehyde, which is manufactured largely in Germany, and generally supplied to the public under the name of "Formalin," which is a 40 per cent. solution of formaldehyde. Not only is this substance used as a general disinfectant but so great is its reputation that lamps have been made which produce it on the small scale

by oxidation of methyl-alcohol in presence of platinum gauze, and such lamps may be used for the purification of rooms which have been inhabited by sick persons.

During the last few years vast numbers of synthetic preparations have been placed on the market for medicinal and other purposes, and it is specially interesting to notice that a large proportion of these are used as germicides, either as general disinfectants or for sterilizing surgical instruments and dressings. In many cases even the substance may be administered internally, and act as an intestinal disinfectant. In looking through such a list of synthetic compounds in a recent publication, no less than 100 preparations with germicidal properties were noticed. Amongst them may be mentioned compounds containing the halogens, silver, mercury, phenol and its derivations, formaldehyde compounds, and also organic peroxides.

The best known halogen compound used as a bactericide is iodoform, the iodine analogue of chloroform, which was first prepared by Serullas in 1832, but not manufactured largely till many years later. One objection to its use as an antiseptic is its powerful smell, and this has led to the introduction of many substitutes, an example of these being xeroform, which is the bismuth compound of Tri-brom-phenol; also loretin, losophan (Tri-iodo-meta-cresol), and sozoiodol (Di-iodo-phenol-sulphonic acid) itrol, largin, lysargin and nargol are silver-containing compounds, whilst hermophenyl and hydrargyol contain mercury. Derivatives of phenol are very numerous, the tri-chlor substitution product being stated to possess twenty-five times the germicidal power of carbolic acid. One very interesting compound is largely used as an intestinal disinfectant, namely salol, or phenyl salicylate. It passes through the stomach unaltered, but is hydrolysed in the duodenum, phenol and salicylic acid being liberated. Alphol and betol are analogous compounds derived respectively from alpha and beta-napthol and salicylic acid.

Compounds breaking down and liberating formaldehyde are beginning to multiply; the simplest being paraform, which gives rise to the aldehyde when heated to 100°, and may thus be used with a spirit lamp for disinfecting apartments. Other products capable of yielding formaldehyde are almatein, dextroform, empyroform, geoform, and glutol.

As previously mentioned the organic peroxides are coming into use under proprietary names as germicides. Alphozone, for example, chemically known as disuccinyl peroxide, is non-toxic and inodorous, and 1 in 5,000 aqueous solution is claimed to be fatal to typhoid bacilli.

Benzoyl peroxide is also a powerful antiseptic, used in medical practice. Perhaps a better production is acetozone, or benzoyl acetyl peroxide. The activity of these bodies depends on the liberation of nascent oxygen in contact with the tissues, the last two preparations also giving rise to benzoic acid, itself a germicide.

Several causes have brought about this flooding of the market with these synthetic compounds. During the past ten years the progress of organic chemistry has made very great strides. Perhaps the most interesting of all is the increasing study of the relation of chemical constitution to physiological activity. It has been definitely proved that the introduction of certain elements or radicles into the molecules of an organic compound will often bring about a very profound change, possibly in toxicity, germicidal power or solubility. An instance mentioned above is the introduction of three atoms of chlorine into the phenol molecule. The resulting tri-chlor-phenol, as stated, is a more powerful germicide than phenol. The increased activity thus brought about is a just and proper cause for the introduction of similar compounds.

Equally important and necessary is the production of innocuous substances with well marked germicidal properties, it being highly important that many antiseptics used in medical practice should be harmless.

Another potent stimulus to the multiplication of synthetic compounds, especially proprietary articles, is trade competition.

Provided the articles produced fulfil all that the makers claim for them this also is a just stimulus, but it is feared that in many cases activity is sacrificed to profit.

It may not be out of place to say a few words about preservatives, which are to all intents identical with disinfectants and antiseptics in their action, preventing the development of bacteria in food and food products. It is generally considered that their use in foods should be either condemned or rigidly restricted.

Formalin, which was spoken of as a disinfectant, is also used as a preservative, especially for milk, as are borax, boracic acid, and salicylic acid.

With regard to disinfectants and antiseptics, there is one point to which supreme importance attaches. In pharmacy it is now recognised beyond dispute that the quality and activity of certain medicinal products cannot be accurately determined by chemical methods, however careful the analyses. In such cases the therapeutic activity should be determined by physiological standardisation, and this method is gaining favour

as time goes on. So with disinfectants: a chemical analysis may reveal the presence or absence of certain bodies, and the results of quantitative examination may be of the utmost importance. But, especially in the case of newly-invented products, their activity should be judged by observing their action on bacteria. For this purpose phenol is used generally as a standard, and the germicidal powers of other disinfectants are denoted in terms of the activity of this bcdy.

In conclusion, it may be asked why disinfectants bring about the death of bacteria with varying degrees of rapidity and in varying concentrations. The problem all centres on the differences between dead and living protoplasm, and till this problem is solved all explanations of physiological activity must of necessity be vague and unsatisfactory.

THE MANUFACTURE OF SOLE LEATHER FROM THE HYGIENIC POINT OF VIEW.

By P. F. SPARKE EVANS.

I PURPOSE to commence by giving you a short sketch of the manufacture of sole leather, so that we may be able to appreciate the manner in which this affects hygiene.

Many people think that tanning is akin to farming, believing that one has only to wait while hides tan and corn grows; but I can assure you it is not so simple a matter.

Bristol has long been noted for its thick sole leather, and the term "Bristol butts" is well known in the trade. These were formerly made from hides imported in large quantities from South America; where, to within the last fifteen years, before the advent of such commodities as Lemco, Oxo, Bovril, &c., the animals were principally bred for the sake of their hides, which became very thick, owing to the cattle living practically in a wild state.

Now, with the importation into South America of English bulls for breeding purposes, the hide is much larger and thinner; and at the same time the demand for the very heavy leather of twenty years ago has diminished to a very marked extent, owing to cycles, motors, electric and other trams, in short to the decreased amount of walking done by people.

Bristol tanners, in common with their confreres throughout the country, have therefore turned their attention to lighter hides, notably those from English and Continental markets.

The method of turning hides into leather may be classed under three heads, each of which is a process in itself.

First the preparation of the hides to take the tan.

Second tanning, or converting the hide-substance into leather.

Third finishing, or preparing the leather for market.

Taking these in order, we come first to the lime yard. This part of the process includes the reception, cleansing, liming, unhairing, fleshing, classifying and deliming of the goods.

The hides are placed in several changes of water, for from six to forty-eight hours. This removes any dirt, blood, &c., and prepares the hides for the liming process (which is the most general one) and consists in treating them with ordinary lime dissolved in water. This solution causes a swelling to take place, and facilitates the removal of the hair. The hides remain in a series of three or four solutions for a total time of from ten to fourteen days. They are then ready to be unhaired. This was formerly done with a blunt knife, but in most yards machines are now used. After unhairing, they are put into clean water, and the flesh is then removed by a sharp knife or machine, great care being required to prevent damage. They are then trimmed into various forms, sorted and again put into water. This washing is very important, for as much as possible of the lime must be removed before tanning, since excess of this substance, in combination with the tan, produces a bad colour when finished.

Secondly, tanning.—This part of the process has undergone many changes in the past twenty years.

Until then, eighteen to twenty-four months to leave the hide in tan was not at all an uncommon time, the chief agent employed being oak-bark. But at the present time tanning takes from four to eight months, although it is claimed by a certain patented process, that it can be done even in two days. In reality, the quicker the time the less valuable the leather; very few of the modern leathers comparing favourably with the oak-bark long-process tannage of fifty years ago. The shortening of this process is achieved by machinery and by the use of imported concentrated tanning materials. Prior to twenty years ago nearly all materials came in bulk, but now by far the largest amount is shipped to this country in the form of extracts, which contain from 25 to 60 per cent. of tan, whereas the bulk materials, from which they are made, contain only 4 to 35 per cent.

The chief materials used in tanning are:—

Oak bark, obtained from Great Britain and Belgium. It contains from 6 to 10 per cent. tan, and produces firm leather with a yellow-red tinge.

Mimosa, from Australia and Natal. The bark of the Wattle tree (acacia) contains 30 to 40 per cent. tan, is quick in action, and produces a light weighing, somewhat pink leather.

Valonia, from Smyrna and Greece. The fruit of the Quercus Ægilops, or Turkish oak, contains 30 to 40 per cent. tan, is slow in action, and produces hard, grey leather.

Myrabolames, from India. The fruit of a tree, contains 30 to 40 per

cent. tan of a very penetrating kind, and produces soft, light-weighing leather, rather yellow.

Sumac, from Sicily, a preparation from the leaves of a tree, contains 20 to 30 per cent. tan, producing soft, light-weighing leather with a light colour.

Quebracho, from South America. Is an extract from the wood of the Quebracho tree, contains 50 to 70 per cent. tan, which is very quick in action, and produces a light-weighing, pink leather.

Gambier, from the Straits Settlements. An extract from the leaves and twigs of the Gambier shrub, contains 30 to 40 per cent. tan, is very quick in its action, and is used principally in the earlier stages of the process.

Mangrove, from Borneo. An extract from the Mangrove tree, contains 50 to 60 per cent. tan, gives softness to the leather, which is red.

Oakwood extract, from Hungary, obtained from the wood of the Slavonian Oak tree, contains 24 to 28 per cent. tan, gives weight and firmness to the leather, which is yellow-brown.

Chesnut extract, from France, Spain and Corsica, obtained from the wood of the Chesnut tree, contains 28 to 33 per cent. tan, gives weight and firmness, with a lighter colour than that obtained by Oakwood extract.

The skill of the tanner is shown in blending the different materials in such proportions as to produce the desired result.

The tanning process is divided into three stages, "poles," "handlers," and "layers."

One of the first aims of a tanner is to get a good colour, and as much weight in his leather as is possible by legitimate means. This is done by allowing the tanning agents to combine with the hides, which are, first of all, suspended on poles in weak liquors, for the double purpose of taking out any lime left in from the preliminary stages in the lime yard, and of swelling and colouring the hide.

Time on poles, eight to twenty days. Series of pits used. They are then removed from the poles, and undergo the second stage of the process, termed "handlers," in which they are constantly shifted. Time, four to eight weeks. Series of pits of increasing strengths.

The third stage, termed "layers," explains itself, and consists in laying the hides away in pits with a certain quantity of material between each. After this they are scoured by machine, in order to take out the creases and to clean the grain. Some tanners then further treat their hides with a bleaching extract in order to brighten the colour, although this is detrimental to the leather, owing to the acid action of the bi-sulphites which most bleaching extracts contain.

The third process is that of finishing. This is really putting a face on, and rolling the leather, so as to make it still more water resistant, and to turn it out as a finished article with a pleasing appearance ready for the boot manufacturer. Time required, fourteen to twenty-one days.

Now that we have considered the legitimate manufacture of leather, we come to the second half of our subject, adulteration.

This is done for two reasons, to brighten the colour and to add weight, in order to be able to sell at a low price or to get an increased profit. The chief offenders in this way are, I am glad to say, not British, but American and continental tanners, and to some extent our Australian cousins, who have been in the habit of using chloride of barium for this purpose. Recent advices from Australia indicate, however, that the Government are bringing pressure to stop this practice.

It is hardly necessary to mention that the chief object of tanning is to make leather resistant to water for as long a time as possible. This can be done by the use of proper tanning materials for a necessary time, and the better a leather is tanned and finished (whereby the cells of the hide are filled with tanning matter) the longer it resists water.

The object of some American tanners seems to be to carry out this process as cheaply as possible, with an unreasonable minimum of tanning material, and in too short a time. They are then confronted with a light-weighing leather. To remedy this, and also for the sake of extra profit, they have recourse to filling their leather with weighting materials. Among these are glucose, Epsom salts, and barium. Now these adulterants, not being tanning materials, will not combine with the leather at all. They are simply deposited in or on the fibres only so long as no water is applied, but directly water is applied the adulterant dissolves, washes out, and leaves a poorly-tanned, very porous, non-water-resisting leather; hence, as can be easily understood, the wearer of such leather is subject to damp feet with its attendant ailments.

The adulteration of American leather is of somewhat recent growth, and it seems clear that a good portion of the blame must rest on the British public, whose one idea seems to be cheapness. Until within the last ten years or so, the American tanner has been able to meet this demand for very cheap leather by the use of the hemlock tree bark. Whole forests have been cut down, and as these trees take many years to grow, the supply is naturally restricted, especially as replanting has not been resorted to to an adequate extent. The result is that the tanners have been obliged to go farther afield for their material, their railway carriage is dearer, and they have been forced to use other and more

CHART (referred to on p. 574), SHOWING THE ADULTERANTS IN SAMPLES OF AMERICAN SOLE-LEATHER.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Nature of Adulterant:—	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Dry sugars (glucose, &c.) ...	8·0	6·2	4·68	10·22	5·46	9·64	5·89	7·54	8·65	6·3	9·73	5·84	10·29	13·46	7·88	8·62	9·84	21·65
Less,—																		
Allowance for natural sugars	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0
Added, as adulterant	6·00	4·20	2·68	8·22	3·46	7·64	3·89	5·54	6·65	4·3	7·73	3·84	8·29	11·46	5·88	6·62	7·84	19·65
Epsom salts	3·32	1·72	—	4·65	—	—	·66	—	2·63	—	4·70	—	2·27	2·86	1·84	4·54	4·42	2·99
Undue moisture	·77	·70	·53	·91	·55	·93	·65	1·12	1·11	·6	1·03	·55	1·14	1·60	·90	·71	1·02	2·34
Total addition of adulterant weighting matter	10·09	6·62	3·21	13·78	4·01	8·57	5·20	6·66	10·39	4·90	13·46	4·39	11·70	15·92	8·62	11·87	13·28	24·98

Excluding Sample R, an average of 9 per cent.

Including Sample R, an average of 10·16 per cent.

expensive substances; and having still to procure a low-priced leather, they have consequently had recourse to the use of non-tanning but weight-giving adulterants.

There are various ways of adulterating leather after the tanning process is finished. One consists of placing it in a revolving drum containing a warm glucose solution. Another is to make a syrup and paste it upon the flesh side of the hide.

To the uninitiated, glucose in leather is somewhat difficult to detect, especially in dry weather, but on exposure to damp it soon manifests itself, if any considerable quantity is present. The leather then at once begins to feel sticky, owing to the glutinous matter oozing out. Cases have been known where bales of American splits, or upper leather, could not be unrolled, the skins being stuck together. One leather merchant known to the writer, suspecting that a shipment from America was not quite right, decided before sending out the consignment, to have some of it made up into boots, and at the present time a pair of these is hanging in his office; and is, as he says, the best weather-prophet he has ever had, a sure signal of approaching rain being the exudation of moisture, owing to the glucose present coming out in solution.

Speaking from personal knowledge, only the other day we had a sample of sole-leather sent to us from New Zealand, to match. It was certainly a beautiful colour, but, on the application of the water test, it was found that ten minutes after water poured through. Now the usual time for a good leather to resist water is from two to four days, and I have seen samples showing no dampness even after twenty-one days.

This New Zealand sample, after being treated with water, was allowed to stand for two days, when a white deposit, like mildew, was noted on the bottom side. This was found to consist of crystalline sodium sulphate. Needless to say, we did not match the leather in this respect.

The question of adulteration had recently been greatly exercising the minds of the best English tanners, and realising the great importance of the question, not only to tanners, but to society at large, some of the Bristol and northern tanners combined to conduct an investigation, in order to ascertain to what extent American leather was adulterated.

In summarising the outcome of this, I wish to acknowledge my indebtedness to the "Year Book of the Manchester and Liverpool Tanners' Federation," whence the figures put before you have been gleaned.

To fairly represent the general run of imports from America, eighteen samples of leather were procured from various sources. These were taken, not because they were suspected of being adulterated, but simply to get a

fair average representation. They were sent to two of the foremost analytical chemists of the leather trade, Dr. J. Gordon Parker, of London, and Dr. Turnbull, of Liverpool, whose dictum cannot be questioned, and who did not know their origin. Their report was even worse than anyone expected would be the case; the Table on page 572 will show you plainly the tremendous extent to which these leathers were adulterated, and these samples were representative, and not selected as being specially suspected. The chemists made every allowance for the natural amount of sugary matter which is present to a small and varying extent in all tanning agents, and for slight moisture, which is inseparable from such materials, and their analysis may be taken as showing absolutely the *added adulterant* matter and moisture.

I will not go step by step through the whole case, but will generalise the results, and show to what a great extent adulteration has taken place, and what a loss to the user this means. One sample was so exceptionally bad that we will exclude it, so as to be just to the remaining seventeen.

In these we find an average of 7 per cent. added glucose and 2 per cent. Epsom salts. On this average, and on the basis of leather imported from the United States for the year ending June 30th, 1905, a total of 24,090,449 lbs., at an average cost of 9·3 pence per lb., this 9 per cent. of useless, and even deleterious adulterant cost the British public £84,015 8s. 6d.

The weight of the glucose would be 753 tons, which, at £11 10s. 0d. per ton, gives £8,659. The Epsom salts would weigh 215 tons, and this, at £3 5s. 0d. per ton, gives £698. In fact, we paid £84,000 for what cost £9,000. Another point to be noted is that glucose is subject to a duty here of 2s. 9d. per cwt. and being smuggled in as leather, duty free, the 753 tons defrauded our treasury of £2,000 duty.

Now, finally, let me again emphasise that leather adulterated with glucose and Epsom salts cannot afford the protection against water as can leather which is free from these materials. Still, if anyone likes damp feet, let him be shod with sugar and salt; but the British public would find it more profitable to buy their glucose as glucose at about 1¼d. per lb., and not as leather, costing between 1s. 2d. and 1s. 6d. per lb.

CONGRESS AT BRISTOL.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS

By COUNCILLOR COLSTON WINTLE,

Chairman, Health Committee City of Bristol.

PRESIDENT OF THE CONFERENCE.

IT affords me infinite pleasure to very heartily welcome you, the representatives of various municipal bodies, to this ancient and historical city of Bristol. We, as citizens, are proud of its antiquity and its historical associations, yet its very antiquity has rendered it a difficult and expensive work to bring the city up to modern requirements. Whether or not we have been successful in this I must leave our visitors to judge, but I think we shall all agree that an improvement has been made since the following verse from the old topical song of "The Golden days of good Queen Bess" was written :—

> "Then our streets were unpav'd and our houses were all thatched, Sir,
> Our windows were all laticed and our doors were only latch'd, Sir,
> Yet so few were the folks who would plunder or would rob, Sir,
> That the hangman was starving for want of a job, Sir."

Let us hope that we have maintained the good character vouched for in the last two lines. I might mention that the records show that Bristol existed before the year 1051, the first Charter being given by King John, when Earl Moreton, about the year 1185; and by the Charter of 1373 Bristol was made a County of itself, and jurisdiction was given to it over the Severn as far as the Holms. It was, however, in 1216 when Henry III., upon the death of John, came to Bristol as to a safe place, that "he permitted the town to choose a Mayor after the manner of London,

and with him were chosen two grave, sad, and worshipful men who were called prepositors, there being neither Sheriff nor Bailiff."

By the enterprise of the Mayor and Corporation in 1247 the present Quay was formed (at the then large expense of £5,000) by cutting through the marsh at the east end of St. Augustine's Church, thus opening a communication with the Avon. At the same time the first bridge was thrown across the river, and Redcliff, which had been an independent borough, was incorporated with Bristol. So highly did Bristol rank as a Port in the fourteenth century, that at the siege of Calais (1347) Edward III. was provided by her burghers with 22 ships and 608 men, London itself being required to send more than these numbers only by 3 ships and 54 men. This naval patriotism did not go unrewarded, for it gained to the town the distinguished Charter that made it a County in itself (dated 8th August, 1373). Among the privileges in this grant were included the return of two representatives to Parliament, and the empowering of the Mayor and Sheriff to elect successively from time to time forty "of the better and more honest men of the town as a Council to rate and levy taxes," etc.

The office of Mayor, as far as we have definite and certain knowledge, was first occupied in 1216, and the office of Sheriff dates from 1373, being sanctioned by the Charter of that year. The office of Lord Mayor was created in 1899. The first mention of the office of Alderman occurs in a by-law 20 Edw. III., which provides that the Mayor shall annually summon before him all the weavers, and that none should be chosen Mayor unless he had been first an Alderman. This shows the importance of the wool trade as allied to the powerful guild of weavers. The docks now in the course of construction show that municipal enterprise in this city is not only a thing of the past, and will we all trust regain for Bristol the position she held in the fourteenth century. To come to the present time, I would point out that the mortality returns show that Bristol takes a front rank as a healthy city. It ocntains over 270 miles of streets and covers an acreage of 17,000, with a population of 363,000, making Bristol one of the six principal cities in population, and the fourth largest urban area in England and Wales in rateable value. Bristol has many natural advantages, the parks and open spaces providing, roughly speaking, one acre to 500 inhabitants. Yet, with all its advantages, I regret to say that on an average more than one person dies daily in Bristol from the "white man's scourge," consumption. In common with other large towns, Bristol is grappling with this large question most seriously, and I trust effectually. As is well known, the infection

of phthisis is conveyed by means of dried expectoration rising as dust in the air. We have already passed a by-law whereby a person expectorating in a public building incurs a penalty. We have initiated a voluntary system of notification of phthisis which works admirably, and until the Public Health Act of 1875 is modified, I am against compulsory notification, for the reason that, if carried to its logical conclusion, no one suffering from phthisis would be allowed in the streets without incurring a penalty. We have, further, on two occasions issued circulars to every householder in the city pointing out the infectivity of this complaint and the best way in which it may be avoided, and upon receipt of the notification, in cases where lack of means justifies it, sputum flasks and disinfectants are provided, with instructions for the use of the same, and where permitted, disinfection of rooms is carried out: this latter, I think, should be made compulsory. Upon receipt of samples of sputum, the bacteriological examination is undertaken by the city. Bristol has also acquired twenty beds in the Winsley Sanatorium, the length of stay for each patient being sixteen weeks; and though it cannot be hoped that in this time the majority of patients can be completely cured, yet, as an educational medium, its value is very great. However, the accommodation afforded is not sufficient to meet the needs of this great city, and it is heartrending to refuse admission on account of want of accommodation. By means of the sanatorium we hope for improvement in the individual patients residing there, and the education derived as to how the patient may best continue on the road towards recovery, and how he may avoid infecting those amongst whom he moves, is a most beneficent work. I look upon the work of prevention as the greater object and the *ultima thule* of our exertions. One uneducated person suffering from phthisis is a danger and a menace to every citizen. I am not at all sure that in dealing with this question provision should not be made for every class of consumptive patient. A sanatorium for cases in the early stages will no doubt oftentimes effect a cure, but the advanced cases, which offer a far greater degree of infectivity, are at present left outside. It is obvious, however, that this system of isolation and education will take some years to become definitely effective, but much can be done at the present time.

Although infection exists to a great extent in all large cities, by increasing the health and the vitality of the inhabitants we shall greatly minimise the chance of the attack of the tubercle bacillus becoming effective, and to this end every effort should be made to increase the air space, and to improve the conditions under which people work and live; also by rigid inspection of the food supply, we shall minimise the serious

risk of lowering the health of the people. In this respect I would only mention meat and milk. We are in Bristol unfortunately situated with regard to the former, inasmuch as there are 114 slaughter-houses scattered throughout the city, rendering adequate inspection impossible except by the constant employment of a large staff of inspectors; but I believe the time will come when no meat will be allowed to be sold unless passed as sound and certified as such by the meat inspectors.

The problem of our milk supply, upon the purity of which depends the health (or lack of it) of a large proportion of our infant population, is one of serious import. Milk being of such an absorptive nature, every care should be taken against contamination at the source of supply, in transit, and at the point of delivery. I fear it will be well-nigh impossible to obtain a pure supply unless every corporation and council throughout the kingdom obtain such laws and make such regulations as to insure a thorough inspection of the cows, and of the manner of milking with sterilisation and bottling of the milk at the source of supply. Although, in common with all large towns, much has been done here, yet much remains to be done, and it is only by constant and strenuous efforts on the part of the representatives of the people that ultimate and full success can be obtained. To increase the health is to increase the wealth, the prosperity, and the happiness of our fellows, and this is an end for which it is well worth striving.

THE RATIONAL EXTENSION OF MODERN CITIES.

By ARTHUR RICHARDSON, M.P.

ONE of the greatest social reformers of the last century said: "There come moments in our lives that summon all our powers, when we feel that, casting away illusions, we must decide and act with our utmost intelligence and energy. So, in the lives of peoples comes periods specially calling for earnestness and intelligence. We seem to have entered one of those periods. Over and over again have nations and civilisations been confronted with problems which, like the riddle of the Sphinx, not to answer was to be destroyed: but never have problems so vast and intricate been presented as those which at the present moment cry aloud for our attention. This is not strange. That the closing years of the last century have brought forth momentous social questions, follows from the material and intellectual progress which has marked its course."

The abnormal growth of large towns and cities presents us with one of these great social problems, the proper housing of the working classes.

Probably the most serious and potent factor in the solution of this problem is the one we are met to discuss to-day. The modern city in this country has been built up piecemeal and in patches, generally without any regard for the artistic, with no attempt on a large scale to lay out building blocks for residences, separate areas for manufactories, wide central spaces for schools, institutes, theatres, churches, etc. Everything in relation to these matters has been allowed to grow according to the idiosyncrasy of the individual builder, without any regard for the common good. The result is large slum areas; dwelling-houses side by side with industrial works; *bona-fide* working men, in order to be near their employment, gradually accommodating themselves to the tenement system; all of which heavily handicap them in the race for bread and lower their moral vitality. In addition to the above drawbacks, in consequence of

our system of rating and taxation, municipal debts are accumulating at such a rate that they become increasingly heavy. The pace we are travelling in this direction is somewhat alarming.

Our municipal debts are increasing in such a degree that, though we are wiping off the National Debt by over £10,000,000 per year, our total indebtedness (national and municipal) increases because of expansion in local expenditure.

In passing, I would like to add the whole of this financial load has to be carried by the workers (brain and hand), whilst the financial profit finds its way into the pockets of the landlords, who do not, as such, contribute a penny through the rates.

The whole of these social difficulties and moral evils have been, and are, aggravated by that modern phenomenon, the migration of the village population to the towns and cities. Seventy years ago, 70 per cent. of our people lived in the rural districts, 30 per cent. in the towns. To-day that has been reversed.

The unemployed question is closely linked with the one we are discussing; and it may be profitable to notice the statement made by the President of the Local Government Board in the House of Commons on the occasion of the Unemployed Debate.

"Ninety per cent. of the unemployable in the cities are town-born men, who have been pushed out of their employment by the village-bred men. These have drifted into the city, driven out of the village by, among other things, the dull, drab life, low pay, lack of vital interest in the soil; and attracted to the city by apparently higher wages, brighter life, and the greater freedom which city life affords."

The efforts of reformers, as taught by the above fact, must be of a two-fold nature:—(*a*) To prevent the influx of village labourers into the cities, thus giving partial relief to the congestion; and (*b*) to secure big belts of land outside cities, but within reasonable distance of industrial works, for building purposes.

One of the principal aims of the intelligent reformer is the prevention of the growth of slums. Every thoughtful and intelligent man who has devoted any serious attention to the housing problem of our great cities, must have realised that much of our cottage property put up in recent years, or now being built, will show very little superiority over the dwellings it displaces when it has been in existence as long as the latter. Faulty design, faulty material, faulty construction, and want of surrounding space, all combine to render the houses but little better than

their predecessors. Many of our municipalities and private owners know what ought to be done, and would be prepared to do it, but for legal and departmental difficulties standing in the way. Local authorities can now buy land either within or without their districts for the construction thereon of workmen's dwellings, but the houses must be built at once, and the purchase-money, if obtained from Public Works Loan Commissioners, repaid within thirty years. What we require is the power to buy large tracts of prospective suburb before it has acquired the price of building-land, such suburban area to be laid out on plan after careful and expert consideration, but only to be built upon when the need for new building arises, and then only in accordance with the pre-arranged plan. The roads should be wide, straight, planted with trees, and arranged to intersect as far as possible at right angles. The area should be segmented, and sections set apart for definite and separate purposes, *e.g.*, one section should be for good class residences, another for workmen's dwellings, another for factories of various kinds and suitable railway-sidings and depots connected with them. Special attention should be paid to the provision of open spaces, and specific sections of these should be set apart and equipped for very young children. Baths should not be forgotten in connection with these. The minimum area allowed for these breathing spaces ought not to be less than one acre in ten. There should be no intrusion of slaughtering establishments or other offensive trades into residential neighbourhoods. If we were in a position to arrange for the future extension of our cities in this way, others should be able to deal with the housing problem in a far more satisfactory manner than we can at present.

When municipalities have acquired belts of land outside circles of their own boundaries, the question that presents itself is, On what principle ought these dwellings to be let? Perhaps a prior question should be—Ought the municipality to build houses for working men, or ought they to let the land on long leases but specify the kind and character of the house to be built? Mr. George Cadbury, speaking at Bourneville on June 6th to members of the Co-operative Congress, said, on this question:—

"Municipalities made a stupendous mistake in buying and pulling down slums. Their part ought to be restricted to the acquirement of land around the centres of population, and letting anyone who chooses to build do so, the municipality exercising the great powers it possesses by law as owner of the land to see that the houses are erected in accordance

with its own ideas. The Bourneville Trust had 500 acres under its control, of which the village occupied 120. The Trust was now about to let 20 acres to a recently-formed Tenants' Co-operative Society at a rental of between 5 and 6 per cent. on the value of the land, which he thought a municipality would be perfectly justified in doing. The land was to be leased upon the Scottish system of renewing the lease every hundred years at a valuation. It was his hope that such a plan would be adopted by municipalities, who would thus benefit by the enhanced value of the land; whilst those who built the houses upon it would not lose them to the freeholder, as was the case under the English law at the expiration of a building lease."

I am of the opinion that Mr. Cadbury's idea as to the principle governing building operations is a workable one. There does not appear to me to be any reason why individuals should not build their own houses with equally good results, always providing the municipality insists on its right to specify the kind of dwelling to be erected. The foregoing method seems to offer a safe way out of the housing difficulty, without committing our local authorities to serious financial risk.

Briefly, the obstacles lying across our path are: the shortness of the term on which the loan is granted, thirty years; compulsion to build immediately; and the indifference and sometimes active opposition of the general public, brought about by the inherent difficulties of the problem, the details of which few understand. The financial risk consequent upon inaccurate estimates as to cost of demolition and removal of condemned property generates dissatisfaction in the minds of ratepayers, often resulting in opposition discouraging to the real reformer.

These facts point one moral. The time has arrived when, in the interests especially of the poor, but also in the interests of the community, the municipality should secure wide strips of land outside the city borders.

What all reformers desire is power to build suitable dwellings for the poorest class. Seeing that the Board of Works Loan Commissioners have full security for money borrowed on land, the thirty years' term ought to be extended to sixty at least; one hundred would be better still. Municipalities would be greatly assisted if, when they borrowed money for building purposes of this description, they were not compelled to build immediately, but only as there arose an effective demand.

The housing problem calls for immediate attention. In Nottingham we have, according to the last census, 350 one-roomed tenements, with families numbering in some cases seven persons; and 1760 two-roomed tenements, with families numbering in a few cases nine persons. How

can we expect human beings to be physically fit and morally healthy under such indecent and foul conditions?

SHERIFF SAMBORNE COOK (Nottingham) said that a great deal of the difficulty in dealing with insanitary areas under the existing law was caused by: 1st, the legal formalities which had to be complied with; 2nd, the large expenditure devolving upon the local authority; 3rd, the poverty of owners, a large quantity of insanitary property being held by persons who could not afford to spend money in improvements; 4th, the rigid and often unreasonable requirements of the Local Government Board in regard to the mode of erecting the new houses; 5th, the difficulty, under the existing law, of acquiring land for new houses at a reasonable price; 6th, the short term granted by the Local Government Board for repayment of the loans.

MRS. S. A. BARNETT (Toynbee Hall, Whitechapel) said she spoke as the Hon. Sec. of the Hampstead Garden Suburb Trust, and one who, after 33 years of life in East London, was conversant with the immoral results of bad housing. The Eton College Trustees owned a beautiful tract of land 1¾ mile long and ½ a mile broad, and this they were willing to sell for the purpose of creating a suburb, which was to be laid out on beautiful as well as on sanitary lines. In order to carry this ideal into realisation a Company had been formed, with The Hon. Alfred Lyttleton, K.C., M.P., as president; the directors of which included Sir Robert Hunter, Mr. Henry Vivian, M.P., and the Speaker. £103,000 had been already invested (out of a capital of £170,000 required), the legal formalities were proceeding, and the roads and buildings would soon be commenced.

BAILIE W. FLEMING ANDERSON (Glasgow) said that Mr. Richardson had made a mistake in describing the Scotch system of renewing the lease every 100 years. Such a system was not in vogue in Scotland. Further, they had not the advantage of the English Act of 1898, giving power to local authorities to acquire land in and outside their boundaries. He did not agree, however, with the idea of acquiring land outside their boundaries. The cure was rather to control all future road making and house building so that we should cease making slums outside while demolishing slums inside. He would suggest that where value has been created by the expenditure of public money, the control and a proportion of the increased value should be annexed by the Corporation or the community which created the value. He was sorry he was not interested in Mrs. Barnett's scheme. He did not much like a 5 per cent. philanthropy, but was certainly not specially interested in people who could occupy villa property at £60 or £70 rent. The sort of people we should help were those women who had 10s. per

week, or a man with 18s. and a wife and family to support out of it. We compelled them to comply with our laws and regulations about cubic space, and yet we knew they could not afford to pay for such space.

Mr. Francois Fremantle (Hertfordshire C.C.) said that a successful experiment in this direction is the Garden City at Letchworth, in Herts. In two years the population of the 3,800 acres acquired under the scheme has risen from 400 to 1,600, and several well-known manufacturers have established factories on acquired sites. The essential point is the emigration of the factory as a nucleus of the population which it is required to rehouse. This should be secured by a law fixing on the employers the responsibility of housing their employés within a limited radius of their works. It is well to look to less closely populated countries, to America and to the Colonies, where new cities are rapidly built from the first with a view to future needs. Legislation should always look twenty-five and if possible fifty years ahead, as was successfully done at Kuala-Lumpur, the fine capital of the Straits Settlements; and as the Russians began to do at Dalny, near Port Arthur. In any extension, building by-laws should be varied for the different parts of the area, and good building may be stimulated by short leases, say for ten years, at peppercorn rent, the lease on renewal to be sold by auction, with a 10 per cent. advantage to the first owner.

BRISTOL MUNICIPAL LODGING HOUSE.

By H. W. HARDING.

ABSTRACT.

THE power of a local authority to provide lodging houses for the working classes is derived from Part III. of the Housing of the Working Classes Act of 1890, but this portion of the Act is not in force in a sanitary district until it has been adopted by the council.

Glasgow must be considered the pioneer in the establishment of lodging houses for the working classes, the council having erected six houses for men and one for women. This example has been followed more recently by many towns in England, the largest and most modern being the lodging houses erected in London by Lord Rowton, and these have served as models for many similar erections throughout the country.

It was not until September, 1899, that the City Council of Bristol decided to purchase a site for the erection of a lodging house at the corner of Wade Street and River Street, St. Jude's.

In July, 1902, sanction was obtained from the Local Government Board to borrow £1,657 for the purchase of land and £7,600 for the erection of the building, the term for repayment being fifty years in the case of the former, and forty years for the latter.

Sanction was obtained in August, 1904, to borrow £1,000 for the furnishing, the time allowed for repayment being ten years.

As the site selected was subject to a ground rent, this was purchased by the Corporation, and compensation was paid in consideration of foregoing any claim for injury, in respect of ancient lights to property in Wade Street. Several dilapidated buildings standing on the ground were pulled down.

The area of the site is 588 square yards, with a frontage to River Street of 88 feet, and to Wade Street of 72 feet. It is in one of the poorer districts of the city, and in a densely populated neighbourhood. The plans for the building were prepared in the office of the city engineer, and the work was carried out under his supervision.

The contract for the erection of the building was signed on April 9th, 1903, and the house was opened on April 20th, 1905. It is four storeys high, exclusive of basement, providing accommodation for 120 men.

The building is of the plainest character, without any architectural pretensions; it is built of Cattybrook red stock bricks, with dressings of artificial stone, manufactured at one of the corporation depots from refuse destructor clinker.

The floors are fireproof, being constructed of cement-concrete and steel joists, and with the exception of those in the basement are laid with $1\frac{1}{4}$ in. pitch-pine battens, set in mastic, and secret nailed to dovetailed bearers, spaced 2 ft. apart. The superiority of this type of floor over wood blocks is that the battens, being nailed to the bearers, there is no opportunity of any portion of the floor working loose, and an important hygienic advantage is that the reduction in the number of joints lessens the chances of harbouring dust and germs; the floors of hall, corridors, and lodgers' kitchen are laid with Ruabon red paving tiles; the basement floors are cement-paving laid in situ; the roofs are of ordinary timber construction covered with plain red Bridgwater tiles; the internal walls and ceilings are plastered with granite plaster.

The drains are constructed of 4 in. and 6 in. glazed stoneware pipes, laid in straight lines to a gradient of 1 in 48, and at all changes of line or of gradient is placed an inspection chamber with air-tight cover. All connections to the drains are made in the manholes, and connected up with 4 in. Winser bends.

FINANCIAL STATEMENT.

	£	s.	d.
Purchase of old property, ground rent, including compensation for ancient lights	1,657	0	0
Cost of erection of building and incidental expenses in connection therewith	7,460	0	0
Furnishing	800	0	0
Total expenditure ...	£9,917	0	0

This expenditure works out very satisfactorily, the cost of the building being £140, and that of the furniture £200 below the city engineer's original estimate.

	£	s.	d.
Average cost per bed:—			
For Furniture	6	13	4
,, Building	62	3	4
Total expenditure per bed	82	12	10
Cost of building per foot cube... ... ...:	0	0	$7\frac{1}{4}$

A MUNICIPAL SCHEME FOR DEALING WITH CONSUMPTION.

By H. SCURFIELD, M.D., D.P.H.
(MEMBER.)

THE Local Government Board of Scotland has recently propounded by means of a circular and the re-issue of a paper by Dr. Philip, of Edinburgh, a complete scheme for dealing with tuberculosis of the lungs.

It may not be uninteresting to point out how the Sheffield scheme. for dealing with this disease is developing, and to what extent it approximates to Dr. Philip's ideal.

Dr. Philip asks for—

1. A Tubercolosis Dispensary.
2. A Sanatorium.
3. A Hospital for Advanced cases.
4. An After-life Colony.

We have not advanced far towards the goal at present. We have:—

1. Compulsory notification, and a scheme approved to use some of the wards of the Isolation Hospitals for educative treatment and the selection of cases for Sanatorium treatment.

2. A Committee appointed for the purpose of establishing a Sanatorium. Some accommodation for open-air treatment provided by both Boards of Guardians.

3. Accommodation for advanced cases provided in separate wards by the Boards of Guardians.

Reverting to Dr. Philip's scheme, I think it will be found that when compulsory notification has been adopted there is no need to establish a Tuberculosis Dispensary.

When we have the use of the Isolation Hospital wards and a Sanatorium the routine will be something as follows:—

1. *Aid to early diagnosis.*—A medical man has a suspicious case. He sends the sputum to the Bacteriological Laboratory of the University, where it is examined free of charge, by arrangement with the Corporation.

2. *Notification.*—If the result of the examination is positive, the case is notified. If the medical man does not wish the case visited by the Tuberculosis Inspector he states so at the time of notification and fills in a special form stating that precautions are being taken to prevent the spread of infection. The form is filled in again every six months during the progress of the case. This procedure is only adopted in from one to two per cent. of the cases notified in Sheffield.

The Compulsory Notification Act has been in force since November 1st, 1903, and there has been no opposition on the part of the public or of the medical practitioners. I have no doubt there has been some little failure to notify on the part of the medical practitioners. This, however, is only what one would expect with a new Act.

The following is a statement of the number of deaths from consumption in the City of Sheffield:—

Period.	Number of Deaths from Tuberculosis of the Lungs.	Number of persons who have Died from Tuberculosis of the Lungs without being notified.
Nov. 1st, 1903, to April 30th, 1904	315	19
May 1st, 1904, to Oct. 31st, 1904	241	19
Nov. 1st, 1904, to April 30th, 1905	272	19
May 1st, 1905, to Oct. 31st, 1905	232	11

3. The following table shows the deaths from tuberculosis of the lungs and the cases notified in the years given. Voluntary notification began in the last month of 1899, and compulsory on November 1st, 1903:—

	1899.	1900.	1901.	1902.	1903.	1904.	1905.
Cases notified	29 (1 month)	309	282	326	519	826	741
Deaths	502	539	580	491	573	536	490

After notification has been in force for a few years, the difference between the cases notified and the deaths will not be so great. The difference between the two figures will be determined by the number who recover or die elsewhere, or who are certified as dying from some other cause.

The number of notified consumptives who are certified as dying from some other cause is considerable. Thus in 1904 twenty-five, and in 1905 twenty-seven notified consumptives were certified as dying from some other cause. In the case of thirteen and nine respectively of these the death was classified as from tuberculosis of the lungs, after consultation with the medical man who signed the certificate.

The period of the disease at which notification will occur will no doubt vary with the circumstances of the patient. Among the well-to-do one

expects early notification. Among the poorer classes the doctor will often not be consulted till the disease is fairly advanced.

The Act has not been in force long enough in Sheffield to enable me to say what period will on the average elapse between notification and death. When it first came into force a large number of cases which were very advanced would be notified.

I find that of the cases notified in the second half of 1904, that is, after the Act had been in operation for eight months, there were

Surviving	3	months after notification	...	62·2	per cent.
"	6	" "	...	52·3	"
"	9	" "	...	45·0	"
"	12	" "	...	39·6	"
"	15	" "	...	35·6	"
"	18	" "	...	33·5	"

3. *Supervision, &c.*—On receipt of the notification a special Inspector visits. He leaves a copy of instructions with the patient or the relatives. He advises as to keeping the windows open and furnishes the poorer of the patients with pocket spittoons free of charge. The spittoons cost 57s. per gross. The Inspector, on his first visit, gets all particulars and the history of the case and pays subsequent visits at regular intervals. In cases where the house is dirty or the patient much confined to the house by his illness the room is disinfected with formalin spray by the Inspector at the time of his visit. The room is also disinfected after death. The householder is asked to notify the death on its occurrence, and in very many cases this request is observed.

If the consumptive is still at work, enquiries are made as to his place of work, with a view to the removal of any causes which may have helped the development of the disease, or to the protection of co-workers from the risk of infection. The fact of workmen at factories having developed consumption is also reported to H.M. Inspector of Factories, so that he may make enquiries as to the efficiency of ventilation, the means adopted for the removal of dust, &c.

4. *Hospital and Sanatorium Treatment.*—When the infectious diseases' hospital wards are available for the reception of the patients, the inspectors will urge the cases notified to take advantage of them according to their circumstances. The idea is to take them for a month, as is done at Brighton, for the purpose of educating them and giving their relatives a rest, and also for the purpose of selecting those who are suitable subjects for sanatorium treatment.

An effort will be made to induce the badly-housed advanced cases at

the end of the month to go into the special wards provided by the guardians.

5. *Hospitals for Advanced Cases.*—There is no doubt that the special wards of the Union hospitals are at present accommodating a large number of the worst-housed cases, and to some extent supplying the need for homes for advanced cases. This has been suggested by Dr. Newsholme as one of the important factors in the decline of the death-rate from consumption.

The following table shows the percentage of the consumption deaths occurring in the Sheffield Workhouse Hospitals and the Sheffield consumption death-rate side by side since 1874:—

TABLE A.—*Phthisis Mortality in City and Workhouse Hospitals.*

Year.	Number of Deaths from Consumption in Workhouse Hospitals.	Number of Deaths from Consumption in the City.	Percentage occurring in Workhouse Hospitals.	Death-rate per 100,000 from Consumption in Sheffield.
1874	25	No record.	No record.	No record.
1875	32	No record.	No record.	No record.
1876	42	638	6·6	243
1877	38	658	5·8	247
1878	39	644	6·1	238
1879	35	601	5·8	218
1880	35	476	7·4	170
1881	41	480	8·5	168
1882	40	551	7·3	191
1883	39	635	6·1	217
1884	No record.	No record.	No record.	No record.
1885	54	560	9·6	183
1886	38	494	7·7	158
1887	54	534	10·1	168
1888	No record.	527	No record.	163
1889	62	552	11·2	168
1890	75	618	12·1	192
1891	81	551	14·7	169
1892	59	459	12·9	139
1893	74	552	13·4	165
1894	72	502	14·3	147
1895	76	473	16·1	136
1896	56	453	12·4	128
1897	90	522	17·2	146
1898	98	448	21·9	123
1899	117	502	23·4	136
1900	135	539	25·0	143
1901	142	580	24·5	141
1902	121	491	24·6	117
1903	142	560	25·4	134
1904	154	536	28·7	124
1905	133	486	27·4	110

The average period of residence of cases of consumption at Firvale Workhouse Hospital has recently been 311 days.

I hope we shall soon have our consumption wards in the Isolation

Hospitals and our Sanatorium in use, and then I consider the scheme will be fairly complete.

6. *After-life Colony.*—The after-life colony is even more in the future. The difficulties do not seem very great. One colony under separate management might serve for several sanatoria. Supposing the cost were £1 per week, the work of the ex-patient would probably be worth 10s. a week on his first arrival, and the local authority might pay a gradually-diminishing charge per week till the ex-patient was able to work for his keep.

COUNCILLOR BONNER (Southampton) agreed with the idea that the principle of compulsory notification for phthisis should not be adopted without a guarantee of the simultaneous provision of adequate inspection, education, and, if necessary, sanatorium accommodation.

MISS JOSEPH (London, Jewish Board of Guardians) said that "where ignorance was bliss, 'twas folly to be wise." Compulsory notification of consumption must bring with it knowledge of the disease, and at least it should be followed by systematic inspection. Perhaps nothing in this connection made one feel more uncomfortable than the knowledge of how phthisis was spread, and how very little was done at present to prevent it.

DR. A. K. CHALMERS (Glasgow) said that the diverse opinions expressed by previous speakers served to emphasize the interest which all felt in the administrative treatment of consumption. Arguments for and against its compulsory notification seemed to find their focus in one paragraph of Dr. Scurfield's paper, where he said that notification would probably do away with the need for establishing dispensaries. There was no question as to the desirability of a local authority knowing where the disease existed. The only question was how best this was to be obtained.

Dr. H. SCURFIELD (Sheffield), in replying, said that he believed in doing something for consumption in all stages. His own experience of fever hospitals and of the Durham Sanatorium had shown him that the cost of a consumptive in a sanatorium was about 2s. 6d. per week more than the cost of a patient in a fever hospital. In Sheffield there were about 1,000 consumptives, and if 40 beds in the fever hospital on the Brighton system and 20 beds in a sanatorium were put at the disposal of consumptives, this, together with the accommodation at present provided by the Guardians, would go a long way towards providing the hospital treatment suitable for each stage of the disease. One of the advantages of compulsory notification was that it enabled one to educate the consumptive directly, which was much more effectual than attempting to educate the whole community in anti-consumption precautions.

A SCHEME FOR THE EMPLOYMENT OF CONSUMPTIVES WHOSE DISEASE HAS BEEN ARRESTED.

By Miss HILDA JOSEPH.

(MEMBER.)

Note.—It must be clearly understood that the scheme here put forward is given in the briefest possible form. Drainage, lighting, building, cost, etc., have been most carefully studied in detail, and the results arrived at would willingly be placed at the service of any who are interested in the scheme.

A GREAT deal has been written and said with regard to the alleged failure of sanatorium treatment for the working classes. It is an undeniable fact, and one well known to those engaged in the fight against tuberculosis, that a very large percentage of poor patients die within a few years of their treatment in sanatoria. The reason for the apparent failure usually given is that consumptive persons of the working classes rarely enter sanatoria sufficiently early in the course of their disease for a cure to be effected.

If an inquiry were carefully made with regard to all those persons who have left sanatoria with their disease arrested, it would be found that probably a large number of women who have husbands or fathers to support them, are doing well, but that a very small percentage of men retain their health, and are able to work for even a few years after treatment.

The reasons for the failure of the present system of after-care are, it seems:—

1. That in perhaps the majority of cases there is no help forthcoming for those who leave sanatoria.

2. That where help is attempted it is not sufficiently understood by those who undertake to find work and supervise these patients; that a residence of three—six months in a sanatorium does not, as a rule, effect

a cure; that the lungs may be patched up, the disease arrested, and the general health greatly improved, but this is all. These people do not, as a rule, realise that the patient's constitution has to be built up afresh, that he should have medical supervision for at least another year or two, and that he is totally unfit at first to do a full day's work.

3. The difficulty of finding any employment for consumptive patients is enormous. Rightly or wrongly there is a great fear in the lay mind of infection from those who have passed through sanatoria. Then, too, the patient's former work is probably unsuitable for him, at any rate under the conditions in which it is usually carried on. His illness may have been largely due to this. The difficulty of inducing a workman to take up some new form of employment can only be realised by those who have attempted it, and this difficulty is naturally much greater if the man has formerly been a skilled worker, making 30s. or even £3 a week, He may for a time take up another job, but sooner or later he usually drifts back to his old trade, or is forced to take to it again because he finds it impossible otherwise to make a living. These difficulties, too, are enormously increased in the case of consumptives, because here it is often necessary to induce men used to sedentary occupations to take up active work, and dwellers in towns to reside in the country.

Brief Outline of the Scheme.

Insufficient thought has been given to the after employment of consumptives, and from this cause much of the curative work, done at so great an expense and to which so much valuable time and effort is given, is thrown away. In the following pages an attempt is made to offer a solution of the difficulty. To those who have not thought over the matter carefully the ideal method would seem to be to put these patients to work upon the land: but, how often is this practicable? They cannot do heavy lifting or digging, for fear of starting hæmorrhage, so that it is next to impossible to place them as labourers, as gardeners, or as farmers, unless, indeed, they were formerly so employed, and so could obtain positions with someone under them to do the heavy work.

Ruling out a farm colony, as a solution of the difficulty, might it not be possible to form a small experimental open air colony in the country, where the patients could be employed on the work at which they were engaged, before they were stricken down by tuberculosis? It is surely economical to make use, whenever possible, of knowledge and skill which has already been acquired. It goes without saying, that the work must be carried on under conditions as hygienic as it is possible for sanitary and

medical science to make them. It is not proposed to separate the colonists from their families. Healthy, open air life, by building up the constitution of the children, would prove a most effectual agent in the prevention of the spread of tuberculosis. Those who have visited the homes of phthisical patients, know well how much illness and how marked a predisposition to consumption are found among the children.

It is realised that many patients, especially those who can only work a portion of the day, and whose families are too young to contribute any appreciable amount to the family exchequer, would fail, at first, to be self-supporting, but it is not proposed to subsidize the wage earners. No colonist would be accepted who had not someone to assist him in case of need. The great majority of working people, who make use of sanatoria, are only able to do so through the outside assistance which they receive, and where the weekly income proved insufficient to feed, clothe, and house the family in comfort, an appointed official of the colony would apply to the society or friend, who had guaranteed to make good any deficit.

The difficulty of obtaining good houses, pure water supply, and sanitary conditions in the country are great, therefore the colony system, which would supply these wants, appears the most advisable.

Land.

Mr. Joseph Fels has most generously offered for the purposes of the colony a plot of land in Essex from 10 to 25 acres, at the nominal rental of £15 to £20 per annum, with option of ultimate ownership or permanent tenure. The site is high, and two miles from a railway station. The conditions imposed are: that a sufficient sum of money be raised to put the enterprise on a proper footing, and that the surplus land be cultivated by the colonists. It would be necessary to ascertain if the site so kindly offered is suitable for the purpose. Mr. Fels naturally desires to discuss the matter with those who may become responsible for the carrying out of the scheme.

Employment of Colonists.

As has been said above, the colony proposed is one in which the patients would principally be engaged on work with which they were familiar. As a large proportion of the consumptives of the East End of London are skilled workers at the tailoring trade, it seems wise to select this trade as the one with which to make our experiment. It has hitherto been prohibited as an employment for consumptives, but it should be possible to prove that it can be carried on under hygienic conditions.

Probably it would be found that the large majority of trades could be

so carried on as to render them quite healthy for consumptives. Should a success be made with tailoring, one of the least hygienic, a distinct gain will have been made. The close and unhealthy atmosphere of the ordinary tailor's workshop, the stooping position of the workers, the heavy irons which must be lifted for pressing purposes, the steam, perhaps containing poisonous dyes, which must be inhaled, and the irregularity and seasonal character of the work, all make it at first sight appear unsuitable for the purpose. But these objections may be overcome. The factory would be built on most hygienic lines; it must be one room deep, with large windows the whole length of the room on both sides. The upper parts of the windows could be constructed so that they could be lowered into the room, to form, as it were, valves on what is known as the "hopper" plan; the lower should be French windows so that they can be opened in their entirety. In the very worst weather, the upper windows on one side of the room could be kept open. Very careful thought has been given to a scheme for carrying on the work in open-air sheds, but it appears to be impracticable. The stooping position of the workers is a serious objection, but could be largely overcome by the use of power machines run by electricity; in this case the basting and finishing only would be done by hand. Daily exercise, which would be insisted upon, would do much to mitigate the bad effects of the sedentary occupation. With regard to pressing, seam pressing can be made suitable for the patients by the use of pressing-machine irons in which the weight of the iron in lifting is reduced by a lever. For final pressing it would be necessary to employ healthy men, as poisonous fumes containing dye may rise from the damp cloth which must be laid on the work. Gas irons are now used in up-to-date factories, and some are excellently constructed, so that the gas is entirely consumed. Tailoring is a season trade, and is at all times irregular. If stock work only be undertaken this difficulty would be avoided, and it should be possible to keep the hands employed during the slack season. Mantle-making could be undertaken as an additional trade, and would admirably suit the purpose of the colony, as mantle makers are busy just when tailors proper are slack. It would be easy to take up the two branches. Several well-known firms who have heard of the proposed scheme have promised to supply tailoring work to the colonists, and their assistance would prove invaluable.

If the first experiment prove successful, factories might afterwards be erected for other trades. Printing and bootmaking have been suggested. With regard to the latter, the phthisical death rate amongst the workers is very high, and in this case great difficulties present themselves. Many of these could no doubt be overcome, but it would be impossible to entirely

do away with the dust generated in the finishing process, and very expensive machinery is now required in a boot factory, so that the work could only be made to pay if undertaken on a very large scale.

Some of the patients and members of their families would probably find employment about the colony as foremen, shop assistants, bakers, barbers, bootmakers, laundresses, dressmakers, milliners, etc. Whenever it was found practicable, the patients would be employed in light farming upon a model farm. Much of the food for the colony might be grown, and eggs, poultry and vegetables sent to market. Poultry farming might be made a speciality, as it would offer light and suitable work for the patients, and could be carried on as part of the general farm work. It would not be necessary to set apart land specially for it. This branch of farming is now recognised as lucrative if carefully managed, an important point in a scheme which must be made as self-supporting as possible. Bee-keeping might also be undertaken.

Buildings other than the Factory.

It is obvious that if the families of the colonists are to accompany them to the colony model cottages must be erected. A farm-building, with a model cowhouse and dairy, are necessary for the carrying out of part of the scheme for the employment of the colonists. A general store and bakehouse might also be suggested, and a social institute, which might possibly form the upper story of the general store. The colonists would pay rent for their cottages, the percentage of interest which they would pay being fixed by those promoting the scheme. It would certainly be found that the cottages would exceed in cost the £150 cottages of the Cheap Cottages Exhibition recently held at Letchworth. In these no allowances had been made for the fees of builder or architect, and materials were charged at cost price; also the £150 did not include bath or other fittings, garden fencing, etc.

School.

The school would be erected by the Local Educational Authority if there were not sufficient accommodation for the children in the schools of the neighbourhood. The children might be given ordinary lessons for part of the day only, and during the remainder of school hours the boys could be taught farming and carpentry, the girls sewing, cooking, laundry work, dairy work and poultry farming. This idea if carried out would fit the pupils for country life, either at home or in the Colonies, and would do much to prevent them from drifting back into the large towns. In all

probability it would be found that the Local Education Authority would approve of this scheme for the education of the children.

It may appear inadvisable that the children of consumptive parents should be thrown so much together, as childish companionship might possibly lead to marriage, but many eminent physicians assure us that the children of such a union, reared under perfectly hygienic conditions, would probably be much stronger than those born of non-consumptive parents living in the East End of London.

THE CARE OF THE HEALTH OF THE RESIDENTS.

The services of a doctor, who should reside in the colony, or within easy reach of it, appear to be indispensable. Each patient must be examined periodically, his exercise regulated, and the amount of work of which he is capable decided upon. The medical man should be in attendance each morning, and should see anyone who was not feeling well. He would afterwards be at liberty to practise outside the colony. He might be paid a retaining fee, to be supplemented by a small compulsory weekly payment collected with the rent from the colonists themselves.

SOCIAL RECREATION.

The dulness of rural life has probably more to do with the exodus to the towns than any other single factor, and it would be essential that the social life of the colony should not be neglected. The proposed social institute might be made a centre of both recreation and instruction; class rooms would form part of it, where on week day evenings English, hygiene, carpentry, cooking, dressmaking, millinery, drilling, etc., might be taught. Such adjuncts as a billiard room, library, reading room, etc., readily suggest themselves. In the large hall debates, concerts, games and dances could take place, and if a stage were provided it should be possible to get amateurs from the nearest large towns to visit the colony and entertain the inmates.

OFFICIALS.

n addition to the doctor, who should preferably reside on the estate, such officials as a steward, a resident electrical engineer, and a lady superintendent seem necessary.

THE COST.

This is worked out in detail to amount to a total of £17,000 for capital expenditure and a working expense, including interest on capital, of £2,142 per annum.

No estimate has been made for salaries paid to those employed in the factory, store or farm, as these would be deducted from the earnings of the different undertakings.

Would it be possible for the colony to earn £2,142 a year?

To consider the tailoring manufactory first. It seems that for the first three to four years money must be lost over this. It would be impossible to make it pay its way with, say, 30 employés who were not working full time. The business could, however, be built up; and in five years' time, if a hundred persons were employed, should make a substantial profit. The fact, however, must not be overlooked that male labour would almost entirely be employed, while other firms with which the factory would be in competition, largely employ females.

The store, if the charges were moderate, and the work of a good quality, should draw customers from the surrounding country. The institute would be supported by the members. The electric light should yield a profit, that is, at least, when the colony has become sufficiently large.

The cottages would be let at such rents as would pay a reasonable percentage on the capital invested, but it must be borne in mind that they would probably be quickly filled, and it would be necessary to build more, so that for some years a considerable sum of money must be put into the scheme to develop it.

It seems then that for at least five years no profit could be hoped for, but, on the contrary, more money would have to be put into the undertaking.

The working of the scheme would doubtless be difficult; some failures are inevitable, but there seems every hope that success would crown the effort. If these hopes are realised, the colony would form an object-lesson to be studied and imitated, possibly to be improved upon, by many countries which are now grappling with the great problem involved in the stamping out of consumption. Surely the day will come when no sanatorium will be opened, without some provision at the same time being made for the after employment of the patients.

Bailie Anderson (Glasgow) said that, in his opinion, we were devoting too much attention to the (so-called) cure and after treatment of phthisis, and too little to its prevention. We should endeavour to improve the homes and the workplaces, and the habits and modes of life of the poor to a greater extent than we had hitherto, for therein lay the true cause of the mischief.

MR. W. H. W. WELLS (Newcastle-upon-Tyne) desired to make a few remarks in the way of extending a part of Mr. Bailie Anderson's speech, which, as a whole, was practically a negative answer to the paper. Mr. Anderson said that one way of lessening the incidence and spread of consumption amongst workers was to prevent overcrowding in workshops. The speaker wished to remind the Conference that, on account of the provisions of the Factory and Workshop Act, overcrowding could not legally be prevented. When the Factory and Workshop Bill was before the country, copies of it were sent to all local authorities, and comments were invited. Among many others, comments were sent in from the authority he had the honour to serve to the effect that, in providing 250 cubic feet of space per worker, a minimum floor space of 25 sq. feet should also be required. This advice was rejected, with the result that, where the workshop was very high, the total cubic space, divided by 250, would often permit as many workers to occupy the room as could be packed close together when standing upright. This was no jest, but a very serious matter.

MR. PETER FYFE (Glasgow) thought we should begin with prevention rather than with cure. We should endeavour to prevent phthisis by dealing with home and workplace in the first instance, rather than enlist public sympathy for hospitals, sanatoria, and after-employment colonies, the very existence of which would be unnecessary if poor people lived and worked under reasonably healthy conditions.

DR. SCURFIELD (Sheffield) pleaded for fair consideration to be given to Miss Joseph's scheme for the employment of consumptives. There was too much of a tendency to meet proposals like this with platitudes, such as "Prevention is better than cure," and "*what* we ought to do is to see that our dwellings and workplaces are so constructed that they will not favour the development of consumption." When were we going to get these model dwellings and workplaces for everybody? Not in the next hundred years. In the meantime, he believed in doing something to prevent the spread of infection.

DR. SYDNEY G. VINTER (Torpoint) had an objection to make to two points in Miss Joseph's paper. The first was that she proposed to employ these consumptives in the making of clothing, and secondly, that consumptive children should attend ordinary schools. Both of these courses were, in his opinion, objectionable and dangerous.

MISS JOSEPH replied, and insisted that the problem of consumption was a very large one, and needed tackling at both ends.

HEALTH VISITING AMONG INFANTS.

By MARGUERITE LE F. BOILEAU, Cert. San. Insp.,

Health Visitor to the Wakefield and District Sanitary Aid Society.

ABSTRACT.

THE strength of our nation, twenty-five years hence, depends on the health of the babies this year and next. In forty years our general death rate has fallen 30 per cent., but we closed last century with the highest average infantile mortality ever recorded, 163 out of every 1000 babies born dying under one year old.

It is a popular misconception that a high infantile mortality merely represents the weeding out of the weakly, and no loss to the community.

(i.) For the ten years, ending 1902, the average infantile mortality was, England and Wales, 152; Scotland, 127; Ireland, 104; Sweden, 99; Norway, 94; New Zealand, 82. Are these races a superior stock to ours? If not, our high rate must be due to bad conditions. These we can alter.

(ii.) Medical opinion to-day gives 75 to 100 as the non-preventable mortality. Anything above this ought to be prevented.

(iii.) The conditions which weed out the weakly, ruin the physique of the strong: they influence the *quality* as much as they do the *quantity* of the survivals: the death rate is only the index of the mischief wrought.

Among the immediately practicable measures for preventing the deterioration of the healthy born, comes the employment of qualified women, to instruct the present generation of mothers in the best methods of rearing infants. This is proving successful in a representative town (population 40,000), where, in two and a half years, I have paid 6,000 visits to over 900 infants.

The health visitor has a field of observation of average conditions unexplored by other workers, and a careful record reveals facts contradicting prevalent assumptions. Mothers certainly appreciate and follow tactful advice individually given. The high local infantile death-rate (ten years to 1904, average 170 per 1,000) is not due to mothers working in mills or to the decline of breast feeding. Only 4 per cent. of mothers are employed,

chiefly charing or washing: over 64 per cent. of infants are breast-reared, under 14 per cent. entirely hand-reared. A milk depot or exclusion of mothers from mills could effect little improvement here.

Analysing 75 consecutive deaths of infants known to me, gives the following primary causes, which appear in no registrar's returns. In the three last classes poverty was frequently a contributory cause:—Eleven deaths non-preventable; 4 due to carelessness; 9 carelessness, with improper feeding; 3 infection and accident; 5 damp houses; 15 improper food or methods of feeding; 28 want of skill, *i.e.*, in homes where skilled attention or the whole attention of an intelligent mother were available, these children would have survived.

Similar conditions doubtless prevail elsewhere. Does not this analysis indicate the loss to the community through ignorance, and therefore the scope for the work of the health visitor?

Our results last year were encouraging. The death-rate among infants visited was under 78 per 1,000. Since 1878 the town's rate has only twice been below the average for England and Wales, and then only by 5 per 1,000: last year it was 22½ per 1,000 below the average, itself a record minimum.

THE UNEMPLOYED WORKMEN ACT.

By Alderman G. PEARSON.

ABSTRACT.

AFTER describing the action of the Bristol Town Council and the Committee appointed to administer the Act, the writer points out that a Labour Exchange and Employment Registry was established and applications were invited with the result that applications were received to the following extent:—

Particulars of applications registered with the Bristol Distress Committee, to the 31st March, 1906.

Date when registration began	20th November, 1905.
Number of persons who applied for Application Forms	3398
Number of applications registered	2900
Number of applicants' dependents	7611

CONDITION OF APPLICANTS.

Married...	2032	Widows	2
Single	701	Living apart from wives	2
Widowers	163		

TRADES OF APPLICANTS.

	Skilled Occupations.	Labourers.		Skilled Occupations.	Labourers.
Bricklayers ...	95	403	Woodworking and Furnishing ...	47	4
Masons... ...	90		Carmen... ...	—	85
Carpenters ...	83	1	Dock Labourers	—	293
Plasterers ...	33	2	General Labourers	—	1117
Plumbers & Gasfitters	8	12	Warehousemen	—	40
Painters ...	205	31	Clerks, etc. ...	33	—
Engineering ...	37	72	Coppersmiths & Brass finishers, etc.	58	—
Shipbuilding ...	3	21	Female Cooks ...	2	—
Textile	1	1			
Boot & Shoe ...	99	3			
Clothing (1 female)	11	3			
Printing & allied trds.	4	3		809	2091

AGES OF APPLICANTS.

Under 20 years ...	91	40 and under 50 years ...	572
20 and under 30 ...	807	50 and under 60 years ...	443
30 and under 40 ...	787	60 years and over ...	200

ALLEGED CAUSES OF UNEMPLOYMENT.

Trade depression ...	1226	Employment unsuitable	15
Work finished	1170	Too old	5
Reduction of staff ...	156	Placed on Army or Navy Reserve	4
Illness of applicant ...	120	Joined Army or Militia training	3
Dispute with employer	38	Removal of employer ...	3
Employer giving up business	29	Insobriety	2
Destruction of premises by fire	27	No reasons assigned ...	57
To better self	23		
Failure of employer ...	22		

*Number of applicants who were in a Provident Society at the time of application.	451	*Number who were formerly in a society, but whose benefits had lapsed owing to distress	168

* This information was not forthcoming in some instances.

NUMBER OF CASES INVESTIGATED BY SUB-COMMITTEES ...		2861
Number recommended for assistance	1408	
Considered of a lesser degree of urgency	661	
Ineligible	443	
Had resumed work at the time of investigation ...	349	

After explaining in detail the course adopted by the Committee for the investigation of the cases, the writer points out that the results of the enquiries go to show that in the main the applicants for work accepted the work offered to them and did it in a manner satisfactory to the Committee, having regard to the fact that they were not used to the work and therefore not able to do so much as men experienced in the particular work would have been able to do. In the opinion of the Committee the applicants as a body were really men out of work, anxious to get work and ready to do their best; the number of cases where work was refused by applicants was very few indeed.

With regard to finance, the results of the appeal to the public were

comparatively small, the total sum received amounted to £1,240 3s. 11d., and but for the assistance of the Queen's fund, from which they received £1,083 10s. 4d., their opportunities of providing work would have been curtailed.

In Bristol, owing to the assistance of the various standing Committees of the Council, who came to the assistance of the Distress Committee, 642 men were employed for an aggregate period of 169,003 hours, the wages paid by such Committees amounting to £4,348 13s. 9d., whilst the Distress Committee were able to employ 274 men for a period of 61,407 hours, for which wages to the amount of £1,522 6s. were paid.

These figures show that whilst the Act is doubtless capable of considerable improvement, it can be worked for the benefit of the poor, and should receive a further trial.

The author is unable to make any suggestion for the provision of the funds necessary in future, and feels that as a last resource application will have to be made to the State, and whilst this is a course fraught with considerable risks he is unable to suggest any other course.

He also makes suggestions for the improvement of the administration of the Act, but such suggestions deal more with the details of administration than the principles underlying the Act.

[*The Proceedings of the Congress will be continued on page 613.*]

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT THE BRISTOL CONGRESS.

RECOMMENDATIONS MADE IN SECTION II.—

"That this meeting recommend the subject of the utilisation of old pits and quarries for rubbish to the Council of The Royal Sanitary Institute, transmitting to them a copy of the By-law of the Stroud Rural District Council, with a view to their making a representation to the Local Government Board, in order to get a general adoption of some such By-law throughout the United Kingdom."

The by-law referred to is as follows:

"*A person shall not place, or cause or suffer to be placed, any filth, dust, ashes, or rubbish removed from any drain, earth closet, privy, ashpit, or cesspool, or other receptacle, in any lissen, cleft, joint, fissure, or parting in the Great Oolite or other rocks.*"

The Council decided to approve and adopt this resolution, and have forwarded it to the Local Government Board.

RECOMMENDATIONS MADE IN THE CONFERENCE OF MUNICIPAL REPRESENTATIVES—

"That the Council of The Royal Sanitary Institute be asked to join with other bodies in organising a Conference on the subject of Employment of Consumptive Patients."

The Council will take this suggestion into consideration when any proposal is made.

RECOMMENDATIONS MADE IN THE CONFERENCE OF MEDICAL OFFICERS OF HEALTH—

"That, in the opinion of this Conference, it is desirable that the County Councils be empowered to form Joint Water Boards and Joint Drainage Boards on similar lines to the powers already possessed in connection with Isolation Hospitals."

"That, in the opinion of this Conference, the time has arrived when the definitions of the words 'drain' and 'sewer' in the Public Health Acts and the Metropolis Management Act should be amended."

The Council decided to approve and adopt these resolutions, and have forwarded them to the Local Government Board.

"That, in the opinion of this Conference, an amendment of the law relating to the protection of infant life is required, in order that any person receiving for hire or reward for a period of more than forty-eight hours *one* or more children under the age of five, should be controlled by the Act; that the County Councils and the County Boroughs outside London be the administrators of the Act."

The Council decided to approve and adopt this resolution, and have forwarded it to the Local Government Board and the Home Office.

"That, in the opinion of this Conference, considering the insanitary condition of many dairies, cowsheds, and milk-shops, which renders the milk supplied under such insanitary conditions unfit for human consumption, it is desirable that legislation be promoted to secure the licensing of all dairies, cowsheds, and milkshops, in lieu of registration as at present; and that the condition of licensing should be that these premises conform in every respect to the local regulations; and this Conference recommends the Council of The Royal Sanitary Institute to bring the proposition under the notice of the proper authorities."

RECOMMENDATIONS MADE IN THE CONFERENCE OF VETERINARY INSPECTORS—

"This meeting of Medical, Veterinary, and Sanitary Officers is of opinion that the present legislation in relation to milk is inefficient, and should be amended, and that the enactments should be made compulsory and general."

The Council have decided to approve and adopt these two resolutions, and have forwarded them to the Local Government Board, urging the desirability of amending the Dairies, Cowsheds, and Milkshops Order so as to require licensing instead of registration, and that the framing and adoption of regulations empowered by the Order should be made compulsory.

RECOMMENDATIONS MADE IN THE CONFERENCE OF SANITARY INSPECTORS—

"That this Conference of Sanitary Inspectors urges the Council of The Royal Sanitary Institute to make strong and early representation to the Local Government Board to obtain powers to compel local sanitary authorities—

(*a*) To provide public abattoirs;

(*b*) To abolish private slaughter-houses;

(*c*) To provide for adequate meat inspection;

(*d*) To enforce the stamping of all meat which has passed inspection."

The Council have decided to approve and adopt this resolution, and have sent it to the Local Government Board.

"This Conference of Sanitary Inspectors requests the Council of The Royal Sanitary Institute, in the interest of public health, to bring to the notice of His Majesty's Government the facts disclosed in Mr. Fyfe's paper upon the Manufacture and Sale of Common Flock Beds, and to urge the Government to make it illegal to manufacture unclean and non-sterile rags and other material into bedding or other forms of upholstery."

As the Council have already been in communication with the Local Government Board on this subject (see page 1013 of Vol. XXV. of the Journal of The Royal Sanitary Institute), they do not consider that any further action is desirable at present.

NOTES ON LEGISLATION AND LAW CASES.

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ELECTRIC LIGHT.—*Electric Lighting—Land acquired under Special Act for Electric Generating Station—Public Health Act, 1875 (38 & 39 Vict., c. 55), s. 175.*

A local authority acting under the powers given to them by a Provisional Order, duly confirmed, which incorporated the Electric Lighting Acts, purchased land by agreement for the purpose of erecting thereon works for generating electricity. Before the purchase they had determined to adopt a scheme proposed by their engineer, under which they were to erect a refuse destructor on part of the land, and use the surplus heat produced by the consumption of refuse in aid of their machinery for generating electricity. The Council had power under the Public Health Act to acquire land for the purposes of erecting a refuse destructor.

Held, as a matter of fact, that the Council had acquired the land in exercise of their powers under the Electric Lighting Acts, and not under the Public Health Act.

Held also, that the erection and use of the refuse destructor was not ancillary to the supply of electricity, and was therefore ultra vires and must be restrained.

Decision of Farwell J. (1905), 2 Ch. 441, affirmed.

ATTORNEY-GENERAL *v.* PONTYPRIDD URBAN DISTRICT COUNCIL. C.A. Vol. II.. Ch. 257.

FACTORY ACTS.—*Landlord and Tenant—Lease—Covenant by Lessee to pay and discharge "Outgoings and Impositions"—Underground Bakehouse—Structural Alterations required by Borough Council—Expenses of—Jurisdiction of High Court ousted—Factory and Workshop Act, 1901 (1 Edw. 7, c. 22), s. 101, sub-ss. 2, 8.*

A lease of premises which were used for the purpose of a baker's shop, and comprised an underground bakehouse, contained a covenant by the lessee to

pay and discharge all burdens, duties, assessments, outgoings, and impositions, charged, assessed, or imposed on the demised premises, or upon the landlord or tenant in respect thereof (landlord's property tax only excepted). The borough council having refused to grant the certificate necessary for the use of the bake-house under the Factory and Workshop Act, 1901, s. 101, sub-s. 2, unless certain structural alterations were made, the assignee of the lease, who was in occupation of the premises, applied to a police magistrate, under sub-s. 8 of the above-mentioned section, to apportion the expenses of the alterations as between the lessors as owners and himself as occupier of the premises, and the magistrate made an order that three fourths of the expenses should be borne by the owners and one fourth by the occupier. The lessors having carried out the requisite alterations, sued the assignee of the lease upon the above-mentioned covenant to recover the total amount of the expenses of those alterations. The defendant paid into court the proportion of the expenses which the magistrate had ordered to be paid by him :—

Held, on the authority of *Horner v. Franklin* [1905] 1 K.B. 479, that the jurisdiction of the High Court was excluded in such a case by the Factory and Workshop Act, 1901, s. 101, sub-s. 8, and therefore the action was not maintainable.

Goldstein v. Hollingsworth [1904] 2 K.B. 578, and *Morris v. Beal* [1904] 2 K.B. 585, discussed.

Stuckey v. Hooke, C.A., Vol. II,, K.B. 20.

LONDON.—*Removal of refuse—Ordinary refuse of hotel—House or trade refuse—Public Health (London) Act, 1891 (54 & 55 Vict., c. 76), ss. 30, 33, 141.*

The ordinary refuse of a hotel, comprising such things as ashes from the grates, sawdust, empty bottles and tins, straw packing cases, tea leaves, waste paper, egg shells, lemon peel, dust from the rooms and staircases, etc., is "house refuse" within the meaning of s. 30 of the Public Health (London) Act, 1891, which the sanitary authority is bound to remove without payment.

In determining whether refuse is house refuse or trade refuse, regard should be had rather to its nature than to its origin or the manner in which it is produced.

Gay v. Cadby [1877] 2 C.P.D. 391, and *St. Martin's Vestry v. Gordon* [1891] 1 Q.B. 61, considered and discussed.

Westminster Corporation v. Gordon Hotels, Limited, Div. Ct., Vol. II., K.B. 39.

POLLUTION OF RIVER BY SEWAGE.—*Sewer—Duties of County Council—Metropolis Management Act, 1855 (18 & 19 Vict., c. 120), s. 135—Metropolis Management Amendment Act, 1858 (21 & 22 Vict., c. 104), s. 1—River Thames.*

Under s. 135 of the Metropolis Management Act, 1855, and s. 1 of the Metropolis Management Amendment Act, 1858, the London County Council, as successors of the Metropolitan Board of Works, have a discretion to decide what sewers and works are necessary in carrying out their duties with regard to the prevention of the sewage of the Metropolis from flowing into the Thames; and therefore they are not bound to construct sewers which would be properly district sewers, for the purpose of intercepting the drainage of every house in the Metropolis that in 1855 drained into the Thames.

WESTMINSTER CORPORATION *v.* LONDON COUNTY COUNCIL. Bray J. Vol. II., K.B. 379.

SALE OF FOOD AND DRUGS ACT, 1875 (38 & 39 Vict. c. 63).—*Importation of Margarine—Package not conspicuously marked—Appeal from conviction of Court of Summary Jurisdiction—Jurisdiction of Court of Quarter Sessions to hear Appeal—Customs Consolidation Act, 1876 (39 & 40 Vict. c. 36)—Sale of Food & Drugs Act, 1899 (62 & 63 Vict. c. 51), s. 25.*

Sect. 25 of the Sale of Food and Drugs Act, 1899, which provides that, unless the context otherwise requires, "An offence under this Act shall be treated as an offence under those Acts" (*i.e.* the Sale of Food and Drugs Acts), does not confer the right of appeal to a Court of quarter sessions from a conviction by a Court of summary jurisdiction under s. 1 of the Act of 1899, of the offence of importing into the United Kingdom margarine in packages not conspicuously marked.

So held by Ridley and Darling JJ., Bray J. dissenting.

THE KING v. OTTO MONSTED, LIMITED, Div. Ct., Vol. II., K.B. 456.

SALE OF FOOD AND DRUGS ACT, 1875 (38 & 39 Vict. c. 63), s. 25.—*Milk—Written Warranty—Future Deliveries—Evidence in Writing to connect Particular Consignment with Warranty.*

In August, 1905, a farmer contracted to supply the respondent with milk, and gave to the respondent a letter stating that he guaranteed that the milk supplied by him to the respondent was perfectly pure and with all its cream. In December, 1905, milk was consigned to the respondent by the farmer and delivered to him under the contract, and the respondent subsequently sold a pint of that milk to the appellant as and for new milk, which upon analysis was found to contain 16 per cent. of added water. On an information against the respondent for having, contrary to the provisions of the Sale of Food and

Drugs Act, 1875, sold the milk not being of the nature, substance, and quality demanded by the appellant, the respondent relied on the warranty contained in the letter as a defence under s. 25 or the Act:—

Held, that a warranty relating to goods not in existence when the warranty is given may be a good warranty within s. 25. But held by Lord Alverstone C.J. and Darling J. (Ridley J. dissenting) that, in the absence of any evidence in writing connecting the particular milk sold to the appellant with the warranty, the warranty afforded no defence to the respondent.

Harris v. May [1883] 12 Q.B.D. 97: *Laidlaw v. Wilson* [1894] 1 Q.B. 74; and *Robertson v. Harris* [1900] 2 Q.B. 117, followed. *Elliott v. Pilcher* [1901] 2 K.B. 817, not followed.

Watts v. Stevens, Div. Ct., Vol. II., K.B. 323.

SALE OF FOOD AND DRUGS ACT, 1875 (38 & 39 Vict., c. 63), s. 25.—*Butter, importation of—Admixture with Foreign Fat—Package not conspicuously marked—Application of Warranty to Importation—Sale of Food and Drugs Act, 1899 (62 & 63 Vict., c. 51), ss. 1, 20, sub-ss. 1, 2, 3.*

Where a defendant is charged under s. 1, sub-s. 1 (*b*), of the Sale of Food and Drugs Act, 1899, with importing into the United Kingdom adulterated butter in packages, not conspicuously marked with a name or description indicating that the butter has been so treated, the fact that he received from the foreign vendor a written warranty of the purity of the butter under circumstances which comply with the provisions of s. 25 of the Sale of Food and Drugs Act, 1875, and s. 20, sub-ss. 1 and 3, of the Sale of Food and Drugs Act, 1899, affords no offence, inasmuch as the written warranty so received only constitutes a defence to a charge of selling adulterated goods in the United Kingdom, and not to a prosecution for importing into the United Kingdom goods in packages insufficiently marked.

Kelly *v.* Lonsdale & Co. Div. Ct., Vol. II., K.B. 486.

SEWERS.—*Drain vested before 1894 in Highway Authority not being a Local Authority—Public Health Act, 1875 (38 & 39 Vict. c. 55) s. 4—Local Government Act, 1894 (56 & 57 Vict. c. 73) s. 25.*

Where before the year 1894 a drain was vested in a highway authority which was not also a sanitary authority, and was consequently not a sewer within the definition in s. 4 of the Public Health Act, 1875, it did not upon the passing of the Local Government Act, 1894, become a sewer by reason of its becoming vested under s. 25 of that Act in a district council which was both a highway authority and a sanitary authority.

Williamson v. Durham Rural Council, Div. Ct., Vol. II., K.B. 65.

DRAINAGE DISTRICT.—*(Scotland)—Public Health—Assessment—Expenses of informing Special District—Public Health (Scotland) Act, 1897 (60 & 61 Vict. c. 38) s. 133.*

By s. 133 of the Public Health (Scotland) Act, 1897: "In any Burgh or where any special drainage district has been formed under this Act . . . . the expenses incurred by the local authority for sewerage or drainage within the same or for the purposes thereof and the sums necessary for payment of any money borrowed thereof either before or after the passing of this Act, together with the interest thereof, shall be paid out of a special sewer assessment which the local authority shall raise and levy on and within such . . . . . special district":—

Held (affirming the decision of the First Division of the Court of Session [1904] 6 F. 553), that where a special drainage district has been formed in a county the local authority is entitled to levy an assessment within the special district to meet expenses, including legal expenses necessarily and properly incurred in connection with, but prior to, the formation of the district.

INVERARITY v. FORFARSHIRE COUNTY COUNCIL, H.L.(Sc.). A.C., Pt. III. 354.

Volume XXVII. No. 11. Issued December, 1906.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONGRESS AT BRISTOL.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By D. S. DAVIES, M.D.,
Medical Officer of Health, Bristol,
PRESIDENT OF THE CONFERENCE.

I DO not propose to repeat from this chair the information as to the present health position of the city of Bristol, which has already been laid before you in the Official Handbook. It may be accepted that so far as regards the general mortality rate the position is satisfactory; that so far as regards the "zymotic" rate, the "fever" rate, and the "diarrhœa" rate the same may be said; and, lastly, that so far as regards that most important point, the infant mortality rate, Bristol holds, in relation to the other large towns of England, a somewhat enviable position.

I may at once state that I think the city of Bristol has some reason to be proud of her position as to these figures, and those who are interested in public health matters may naturally ask to what Bristol owes such generally favourable returns.

The observant layman, visiting the district for the first time, might be pardoned for deciding, as he surveys from the vantage point of Brandon Hill or of Clifton Down the romantic position of the city, nestling in a broad valley, stretching its lines of streets and houses up and over the hills on one side, as though to gain a view of the broad estuary of the Severn flanked by the hills of Wales, and to inhale the breeze blowing straight in from the Western Ocean; stretching towards the other side

over the undulating country that reaches towards the Mendips; such an observer might, I say, be pardoned for concluding that the commanding natural position of the city sufficiently accounted for its favourable health returns.

But no one of those here present would fail to remind him that the health of a city is a composite factor, that one set of favourable conditions may account for the absence or small fatality of one class of disease, while another totally different set of favourable conditions would be needed to explain immunity from another class of disease; furthermore, that the favourable conditions are sometimes local and sometimes personal, so that the health condition is a resultant of the various favourable or unfavourable conditions interacting amongst persons and places, and is not a simple result due to a single cause.

And again, it is a fact that, although this beautiful city enjoyed the same advantages of site as it does now, before the sanitary awakening of the last century, want of appreciation of the elementary necessities for healthy communal life had produced a condition of things in Bristol that was simply deplorable.

I have before me a report (long out of print) of very great interest to the city, dated 1850, and presented by Mr. Geo. T. Clark, Superintendent Inspector to the General Board of Health of that period. It represents the results of a preliminary inquiry into the sewerage, drainage, and supply of water, and into the general sanitary condition of the inhabitants of the City and County of Bristol. From this report it is abundantly evident that neither its natural position nor its proximity to the sea breezes were sufficient to reverse the inevitable results of man's ignorance or carelessness, or both, in regard to the provision of the necessary conditions for healthy existence in a crowded city.

The population then numbered some 140,000 (it is now 363,000). The death-rate for the City of Bristol, including the older and more central wards, St. Augustine, Castle Precincts, St. James, Redcliffe, and St. Paul, was, over an average of seven years, no less than 27 per 1,000; and for the Clifton union, including Clifton, St. Philip, Ashley, and Westbury, was for the same period 24.

This volume is full of the most interesting particulars, showing how general was at that time the neglect of the most ordinary sanitary precautions, not only in the crowded courts of the City and Clifton, but in many of the main streets and thoroughfares.

I do think that our visitors to the Congress this week will not recognise the Inspector's description of the White Ladies' Road in 1850:

"The White Ladies' Road has an open gutter, down which the house drainage runs into a side ditch, and is most offensive. The road is very imperfectly lighted, some of the lamps being 80 yards apart. Lower down, opposite Garraway & Maye's Nursery, the drain is peculiarly offensive. Above White Ladies' Gate (near the present Clifton Down Station) in the bottom of the valley, several open drains meet, and their contents are generally complained of. In a field in front of West Clifton Terrace the sewage escapes over a large space. The whole of this nuisance is by the side of a great thoroughfare, and in front of excellent houses, all of which drain either into cesspools or into these ditches."

The Inspector's comments on the water supply in the same report state that until about two years before Bristol was worse supplied with water than any great city in England. Its ancient citizens, indeed, who built churches and founded schools and charities, did not neglect to supply their city with this great necessary of life, but the old conduits had not been extended, and the Clifton supply, for example, was confined to the houses of the rich; the poor at all times had to fetch water, and in summer many of them were forced to go for it to considerable distances; water carrying was a lucrative trade, and the poor paid from ½d. to 1d. a bucket. The New Water Co., as it was then called, very soon, by its progressive and active private enterprise, removed this reproach.

We can hardly be surprised that the Inspector in his summary, remarked: "The mortality of the city of Bristol and the sickness which it represents are the cause of great pecuniary loss to the city, from the increase which is thus brought upon the poor's rate, both from the loss of productive labour, the cost of medicines and relief, and the support of widows and orphans; and that this excessive mortality, sickness and consequent expense are to be attributed in a very great measure to the bad condition of the houses of the labouring classes, which suffer from want of drainage, water, and house accommodation; to the filthy state of most of the suburban streets and lanes, and to the want—save in the old city and a part of Clifton—of scavenging arrangements."

The Inspector insisted also upon the fact that the powers of the local governments, whether parochial or under local Acts, are quite insufficient for the sanitary wants of the city, and even were they more extensive, would still remain insufficient, unless administered by one body over the whole municipal area.

To my mind there is a great deal more in such a description of sanitary deficiencies than the mere dramatic picture of filth heaps and open sewers. These abominations are only the outward and visible signs

of municipal apathy and of lack of intelligent control. These foul conditions would serve to foster only some of the ills from which the city suffered; but with this evidence of entire absence of a sanitary conscience, there is little wonder that in every conceivable way disease would take advantage of its natural methods of spreading, unhindered by any reasonable or well-considered measures of prevention.

Shortly before this report appeared, cholera, grim in its lessons, but beneficent in its results, had claimed two thousand victims, and had given strong impulse to reform. Private enterprise looked for and provided water; a general and well-considered scheme of sewerage was not long in following. But still typhus fever was endemic, smallpox paid frequent and fatal visits, scarlet fever was far too common and fatal. It was seen that though measures of general sanitation formed the essential groundwork of municipal health, further measures in the way of supervision and control, isolation and disinfection, were necessary to check the spread of the large group of diseases which depended rather upon personal communication than upon local insanitary conditions.

In 1865, then, the first health officer was appointed, and by vigorous isolation and administration succeeded in giving decided check to the encroachments of typhus, a disease which has since languished and died out.

In the following year cholera gave opportunity for testing the value of measures based upon study of the life-history of the disease, and a vigorous policy of isolation, disinfection, and protection of water supplies resulted in gratifying success.

These early successes seem to have had the result of somewhat retarding progress, for in the matter of isolation accommodation for fevers the guardians were permitted for many years to retain in their hands the main provision of hospitals. Indeed, it was not until after 1893 that the whole responsibility for this provision was taken over by the Corporation and the erection of modern hospitals begun in earnest.

But although Bristol is somewhat cautious in adopting new methods, she must have the credit of following a good lead when she has proved it to be good. The various enactments which have from time to time supplemented the main Public Health Act have all received attention and have had provision made for their enforcement. Bristol may not force the pace in regard to every regulation or requirement that the earnest reformer demands, but she will take care that what seems reasonably necessary is carried out.

I have in some degree taken you into my confidence in regard to the character of a city which has, at any rate, attained to an enviable

position from a health point of view, from a condition once as bad as it was possible to conceive. That further progress is possible and desirable I fully admit, and there are most favourable indications that public opinion will support continuous, well-considered progress in many directions, not least in the direction of dealing with the question of infant mortality, which, though it shows favourable figures for Bristol amongst the large towns, is yet in my opinion susceptible of considerable improvement. I also hope that, at no distant time, medical supervision of scholars will be satisfactorily arranged for.

But I must not detain you in voicing all my hopes for the future. The efficiency of public health administration is closely bound up with the powers under which we act; and, although tact and discretion, and I may add, occasionally a little assumption of power, may suffice to tide us over difficulties, it is nevertheless unsatisfactory and difficult to carry out our full duties unless we are properly supported by adequate statutory authority. No one is so well qualified to appreciate the deficiency of an Act as the man who has to work it. I look forward, therefore, to the suggestions which are to be made and to the discussion that will follow with confidence for much help and enlightenment.

Discussion on "The need for additional powers and the amendment of the existing laws, for greater efficiency in public health administration."

JOINT WATER & DRAINAGE BOARDS,

By H. MEREDITH RICHARDS, M.D.,
Medical Officer of Health, Croydon.
(FELLOW.)

IT is doubtless common ground with most of us that decentralisation in local government has proceeded too far, and that the division of the country into small urban and rural districts has many serious disadvantages. Not the least of these is the incapacity of small districts to carry out comprehensive water, sewerage, and sewage-disposal schemes. This incapacity arises from various obvious causes, and especially from lack of funds, absence of sufficiently skilled advisers, and unwillingness to voluntarily combine with neighbouring districts. Some of these difficulties will be better appreciated if concrete instances are described.

Take first the case of public water supplies. An urban district, A, has very ample reservoir capacity, but an insufficient gathering ground. The neighbouring district, B, has a very large gathering ground, which it cannot properly make use of because the geological formation is such that a large storage reservoir cannot be constructed at anything like a reasonable cost. Obviously the proper course is for the two districts to form a joint water board and use A's reservoirs for the storage of water from B's gathering ground. This was proposed several years ago, but owing to local jealousies has never been carried into effect. Were the administrative county given the power suggested in the resolution, they could compel the districts to unite, unless the Local Government Board decided otherwise on appeal from either authority.

Take, again, the various water authorities that are deriving their supply from wells sunk in the chalk in Surrey and Kent. Everyone who is familiar with the district knows that, owing to the mutual opposition of adjacent authorities, this splendid source of supply is not being used to the best advantage.

Similarly, sewerage and sewage disposal schemes are often insufficient and unduly costly because each small authority endeavours to carry out a system of its own, though a joint scheme would often be more simple and cost less in up-keep. In my own district a small urban district is at the present moment seeking power to borrow money (I believe £60,000 in all) for a most elaborate sewerage and sewage-disposal scheme, though the main sewers of an adjacent authority are within easy reach.

Doubtless many present can recall numerous similar anomalies, and I have, therefore, every confidence in moving the resolution standing in my name:—

RESOLUTION.

That, in the opinion of this Conference, it is desirable that County Councils be empowered to form Joint Water Boards and Joint Drainage Boards on similar lines to the powers already possessed in connection with Isolation Hospitals.

DR. J. R. KAYE (W. Riding C.C.) seconded the resolution presented by Dr. Richards. The difficulties arose in connection with the buying-up of gathering grounds, and also in the distribution of the water. Corporations took gathering grounds in excess of their requirements, and small sanitary authorities nearer those grounds were often deprived of their birthright. Then it happened that a water-vending authority, A, sold to B, and B to C. The last required a supply to some small village, and it was necessary that A approve of B selling to C. The result was frequently disagreement and delay.

DR. MIDDLETON MARTIN (Gloucester) considered that the powers proposed to be given to county councils would be very valuable, and would have an important indirect bearing. At the present time one reason given by county councils for not appointing county medical officers of health was that even if they appointed one, he had no powers. Therefore the more direct power that could be given to county councils in sanitary matters, the greater the probability that county medical officers would be appointed by county councils. In those counties where county medical officers had made a strong position, they were of the greatest assistance to district medical officers of health, who had difficulty in inducing dilatory district councils to move in sanitary matters.

DR. HENRY E. ARMSTRONG (Newcastle-upon-Tyne) supported the resolution, and in so doing advocated the union of sanitary authorities into a *national*, non-political body for dealing with this subject, milk supply, and several other matters, which cannot be efficiently handled under existing conditions, owing to the distance between the different districts concerned, the divergence between the respective interests involved, and for other reasons.

The resolution was carried.*

* Resolutions passed are referred to the Council, and their decision is given on page 605, No. 10.

DEFINITION OF DRAIN AND SEWER,

By JOHN ROBERTSON, M.D.

THERE is probably not a district in the whole of England where, within the last ten or twenty years, real difficulties have not occurred in deciding what is a drain and what is a sewer. While this is generally true in the great majority of towns, the question is one of everyday worry and anxiety, and in a great many cases of obvious injustice.

It will be found in practice that the type of drainage arrangements in different towns varies a great deal. In certain of our Lancashire and Yorkshire towns with long back passages there is not nearly so much difficulty as in the case of court-yard towns. The amount of bad feeling and friction which has been generated between municipal authorities on the one hand, and local surveyors and property owners on the other, is very great. The expense to property owners and the profit to the legal profession is considerable at the present time.

Numerous books have been written on the law relating to drains and sewers, mainly with the object of making it more clear as to what is a drain and what is a sewer. Mr. Macmorran's book of 853 pages is one of the latest of these.

When we look into the case law on the subject, and read many of the conflicting decisions, we are struck with, apparently, an absence of common sense in many of the important cases. When we hear of rain-water gutters becoming sewers, and of rain-water spouts being sewers, and of the drainage from houses flowing first of all through drains into sewers, and then again through a drain before it enters the real sewer, I think one is justified in suggesting that some common-sense action should be taken to settle the matter.

For many corporations the matter is one of very great importance from the point of view of the rates. A wrong interpretation of the meaning of the words may mean a difference of anything between £5,000 and £10,000 a year in our larger municipalities in the upkeep of what are obviously drains.

I feel strongly that the question is not so difficult as at first sight it appears to be. Only ten or fifteen years ago, the owners of property built their houses and paid for the drains with the clear understanding that whether they were separate or combined, or tangled in any way one likes to imagine, they were things which it was their duty to repair and keep right for ever.

Quibbles in interpretation of the law have made it possible to raise a doubt as to whether almost everyone of these old drains is a drain or sewer. My own feeling is that the best solution of the difficulty will be somewhat in the direction of requiring owners to keep their drains or sewers in repair on private property, while the municipality keeps the drains and sewers in the public highway in repair. I am aware, of course, that there are sewers running across private property which it would be perfectly easy to exempt, and also that there are several other contingencies which would have to be provided for; but the main lines on which I would look for the amendment in the law are in the direction of making the owner responsible for everything which is on his property, allowing the municipality to be responsible for that part of the drain which connects to the sewer and which is in the road.

RESOLUTION.

That, in the opinion of this Conference, the time has arrived when the definitions of the words "drain" and "sewer" in the Public Health Acts and the Metropolis Management Act should be amended."

MR. SNAITH (Birkenhead) seconded the resolution.

DR. BOND (Gloucester) said that the subject under discussion was a very complicated and difficult one, which could not be simplified by a mere variation of definitions. It was partly a question of law and partly of fact in each case. What seemed to be wanted was a codification of the law as established by judicial decisions. After that had been done, the question of definition would follow as a matter of course.

COUNCILLOR MACLURE (Belfast) said that the tangled subject of drains and sewers was one that the authorities in Belfast had had considerable trouble with. By their own local Acts a drain was defined as belonging to the owner of the premises served by it, and must be kept in repair by him, the Corporation being responsible for the main sewer in the street only. By the Public Health Act a drain became a sewer when it drained more than one house. Their very able town clerk, Sir Samuel Black, often expressed his dissatisfaction with the

absurd changes made by the Public Health Act. He voiced the mind of the health authority when he said they would gladly welcome amendments in this Act.

Dr. H. Manley (West Bromwich) said the difficulty had greatly arisen from Sect. 19 of the Public Health Acts Amendment Act, 1890, which was really intended to apportion the expenses among the property owners where there are more than one. The rights of the local authority against the person by whose act or default the common drain (or sewer) came into disrepair are identical in both cases.

The President of the Conference (Dr. D. S. Davies, Bristol) said that considerable difficulty had from time to time arisen in Bristol in regard to Sect. 19, Public Health Acts Amendment Act, 1890, and to the definition of sewer and drain in the Public Health Act, 1875. To meet this difficulty the Corporation introduced Section 34 in the Bristol Corporation Act, 1905, and since then no difficulty had arisen. The section was as follows:—

THE BRISTOL CORPORATION ACT, 1905, Section 34
(5 Edward VII., Session 1905).

(1) Where two or more houses or premises are connected with a single private drain which conveys their drainage into a public sewer, the Corporation shall have all the powers conferred by Section 41 of "The Public Health Act, 1875," and the Corporation may recover any expenses incurred by them in executing any works under the powers conferred on them by that section from the owners of the houses in such proportions as shall be settled by the city surveyor, or (in case of dispute) by arbitration under "The Public Health Act, 1875," or by a court of summary jurisdiction, and such expenses shall be recoverable summarily as a civil debt, or the Corporation may declare them to be private improvement expenses, and may recover them accordingly.

(2) Section 19 of the Public Health Acts Amendment Act, 1890, shall cease to be in force within the city.

(3) For the purposes of this section, the expression "drain" includes any sewer or drain, whether constructed before or after the passing of this Act, with which two or more houses or premises (whether belonging to the same or different owners) are at the date of the passing of this Act, or may at any time hereafter be connected, or which is used, or capable of being or intended to be used, for the conveyance of the drainage of such houses or premises directly, or by means of any other sewer or drain to any public sewer situate under a street repairable by the inhabitants at large, but shall not include any sewer which has been constructed to the satisfaction of the Corporation under Section 150 of "The Public Health Act, 1875," or any sewer which has been constructed by the Corporation for the effectual drainage of the city.

The resolution was carried.*

* Resolutions passed are referred to the Council, and their decision is given on page 606, No. 10.

INFANT LIFE PROTECTION.

By A. WELLESLEY HARRIS, M.D.
(FELLOW.)

ALL persons interested in public health matters have suddenly bestirred themselves into considering the best means of lessening infantile mortality, and of remedying the conditions which for so long have been neglected.

The wastage of infant life is enormous, and although we all agree that deaths of infants under 1 year must exist in a large proportion, we know, as sanitarians, that a considerable percentage of these deaths are due to preventable diseases, and every step is being taken by public health authorities to improve the environment of infants, to educate the parents in the feeding and management of their young, and even to provide specially prepared food to those who are either unable to nurse their children or to provide them with satisfactory substitutes for breast milk.

In the crusade against infantile mortality, no action has been taken, so far as I am aware, to improve the condition of a large number of children who are for special reasons entrusted to the care of absolute strangers. I refer to children put out to nurse.

As you are aware, certain protection is afforded by the Infant Life Protection Act, an Act which requires the registration of all persons receiving for hire or reward for a period of more than 48 hours, two or more children under the age of five. Beyond this registration, there is a certain amount of salutary control over the persons referred to. Unfortunately, however, there are a very large number of nurse children who are not in registered homes, the receivers of the children contracting out of the Act by not receiving more than one child at a time.

The controlling authority under the Act is the London County Council in London, and outside the Metropolitan area the Boards of Guardians.

In regard to the administration in London, I think there can be no doubt that the powers should be transferred to the Metropolitan Borough Councils, who now receive a return of all births in the district, and are likely to receive other information which the London County Council

could not obtain. Further, the Borough Councils are provided with the staff necessary for efficient administration. At present, in London, the Act has not even the advantage of being administered by the Public Health Department of the London County Council, but is governed by the Public Control Department, and on examining the last report one finds matter relating to this very important subject sandwiched in between reports in regard to the Explosives Act, glanders and rabies, the importation of dogs, and swine fever.

In areas outside London the powers should be transferred from the Boards of Guardians to the local sanitary authorities.

From your experience as medical officers of provincial towns, I am sure you will agree that such an alteration is desirable.

I have pleasure in moving the following resolution:—

RESOLUTION.

That, in the opinion of this Conference, an amendment of the law relating to the protection of infant life is required, in order that any person receiving for hire or reward for a period of more than 48 hours *one* or more children under the age of five, should be controlled by the Act; that the administration of the Act should be transferred from the Boards of Guardians to the Local Sanitary Authorities, and in London, from the London County Council to the Borough Councils.

DR. H. SCURFIELD (Sheffield) seconded the resolution proposed by Dr. Harris. He thought it was most necessary that the protection of the Act should be extended to all farmed-out children.

DR. H. M. RICHARDS (Croydon) supported the resolution, and instanced a case which had come under his personal notice within the last week or so. An illegitimate child was being well cared for at a registered house. The inspectress had reason to suspect that the death of the infant would be not unwelcome, and this suspicion was strengthened on her ascertaining that the mother proposed to remove the infant to a home where only one child was taken, and where there would therefore not be any supervision. He deprecated the transfer of the powers to smaller local authorities, but considered that the inspection should be done by the county council and not by the guardians.

DR. E. DAVIES (London) supported the proposal that the reception of single infants should be registered, because the opportunities of concealment of improper treatment were not halved but doubled in the case of single infants.

DR. MARTIN (Gloucester C.C.) strongly supported the resolution on the evidence given at the National Conference on Infantile Mortality, where it was

stated by those who had considerable experience of the working of the existing Act that women would reduce the number of children they formerly took, so as to escape supervision under the Act. It was essential that these cases should be brought under efficient inspection.

MR. HARDING ROBERTS (Holywell) was of opinion that the question should not be passed without due consideration on the part of such an important gathering. The object of the Infant Life Protection Act was to prevent baby-farming, and that object could be attained if the Act were rigidly enforced. There was a large number of cases where it would be an extreme hardship if each single child had to be registered, and he disagreed with the first part of the resolution. He also disagreed with the second part: the transferring the carrying out of the Act from the boards of guardians to any other authority. He contended that boards of guardians had the requisite efficient machinery for working the Act, and that it was not desirable to transfer it to any other authority, who would either have to create new machinery or be ineffective.

DR. HOWARD JONES (Newport) said the remarks of Mr. Harding Roberts called for serious comment. If any infants did require protection, they were those born out of wedlock. It was the speaker's practice to tabulate the deaths among illegitimate children separately from legitimate children. Last year, at Newport, the death-rate among illegitimate children was 366 per 1,000 births, compared with 121 per 1,000 among other infants. This pointed to the necessity for supervision over the houses receiving such children.

DR. FRANCIS FREMANTLE (Hertfordshire) said if any change took place, it should be to the authority that carried out the Midwives Act. The work of supervision of midwives and the work of infant protection largely coincided.

DR. KAYE (West Riding C.C.) proposed the following amendment:—

That the county councils and county boroughs outside London be the administrators of the Act.

DR. HANDFORD (Nottingham C.C.) seconded the amendment, and pointed out that the omission of the word "local" made no difference. The county councils were not sanitary authorities except for special purposes; and the resolution, if passed, would in country districts leave the administration in the same hands as before, since in many instances the boards of guardians and the rural district councils consisted of the same persons. When the administration of the Midwives Act had been delegated to the district councils, the results had not been so good as was expected, and infant life protection was a very similar matter.

DR. EUSTACE HILL (Durham C.C.) did not think representatives at this Conference outside London could vote on the second part of the resolution without

knowing the reason why the administration of the Act should be transferred from the London County Council to the London Borough Councils. The reason for the change had not been touched upon by the mover of the resolution.

Dr. Willoughby (Eastbourne) said that no reason had been given for the transference of the powers from guardians to county councils, and until it had been shown that the guardians neglected their duties in this respect, why should the transfer take place? The guardians had the machinery and the county councils often had not. If the powers were to be transferred, it should be to sanitary authorities rather than to county councils, who often had no medical officers.

Alderman Henry Dunn (W. Riding C.C.) drew attention to the fact that while the baby farmer desired to preserve the children for gain, the woman who took single infants (to prevent inspection) might desire to destroy them. It was absolutely necessary that single infants put out to nurse should have the same supervision and oversight as may be provided for two or more infants.

Resolution.

The following was finally carried:—*

> That, in the opinion of this Conference, an amendment of the law relating to the protection of infant life is required, in order that any person receiving for hire or reward for a period of more than 48 hours *one* or more children under the age of five, should be controlled by the Act: and that the county councils and county boroughs outside London be the administrators of the Act.

* Resolutions passed are referred to the Council, and their decision is given on page 606, No. 10.

DESIRABILITY OF LICENSING DAIRIES, COWSHEDS, & MILKSHOPS IN LIEU OF REGISTRATION.

By HENRY RENNEY, M.D., B.Hy., D.P.H.,

Medical Officer of Health, Sunderland.

(MEMBER.)

THE Infectious Diseases (Prevention) Act, 1890, defines a dairy as including any farm, farmhouse, cowshed, milk-store, milk-shop, or other place from which milk is *supplied*, or in which milk is *kept for purposes of sale.*

For the purposes of this discussion perhaps it would be advisable briefly to refresh our memories as to the provisions of the Dairies, Cowsheds, and Milkshops Order of 1885.

Under this order, together with the Amending Act (the Contagious Diseases (Animals) Act) of 1886, and the Dairies, Cowsheds, and Milkshops Amending Order of 1886, every person who carries on the trade of cowkeeper, dairyman, or purveyor of milk in the district of any local authority must be registered. *Once registered, the authority cannot remove the name of any person from the register.* The sanitary authority may make regulations which, if not considered of too stringent a nature by the Local Government Board, will come into force after one month's notice has been given. Penalties may be inflicted for non-compliance with the regulations. By the order provision must be made for lighting, ventilation, air space, cleansing, drainage, and water supply of a cowshed or dairy (section 7).

Section 8 forbids the occupation of a dairy or cowshed, whether so occupied at the commencement of the order or not, unless all these provisions are made to the satisfaction of the local authority.

Section 9 deals with infectious diseases.

Section 10 forbids a water-closet, earth-closet, privy, cesspool, or

urinal to be within, communicate directly with, or ventilate into any dairy or room used as a milk-store or milk-shop.

Section 11 declares that a cowkeeper, dairyman, or purveyor of milk shall not use, or permit to be used, a milk-store or milk-shop as a sleeping apartment, or for any purpose incompatible with the proper preservation of the cleanliness of the milk-store, etc., and of the vessels, or likely to contaminate the milk.

Section 12 forbids the keeping of swine in such places.

Section 13 gives power to the sanitary authority to make regulations, and section 15 forbids the mixing of milk from diseased cattle with other milk, or the selling of such milk for human food.

At first sight this order, and the regulations which the sanitary authority have power to make, seem to give us all that is necessary for ensuring clean dairies, cowsheds, and milkshops, but in practice this is not so.

Take the case of milk-shops; in the poorer parts of a town it is common to find numbers of small shops in one street, often quite close together, the proprietors of which sell from a quart to a gallon of milk per day. These shops are usually small grocers' or general-dealers', and on inspecting them one finds the milk contained in an earthenware vessel without any covering, standing on the counter. (I have seen it kept in a dirty zinc pail.) In close proximity to the milk are pickles, kippered herring, onions, flour, coals, perhaps an open tin of so-called preserved meat, and even paraffin oil. The atmosphere is close, stuffy, and laden with heavy odour from the combination of articles mentioned. The floor is dirty with a layer of dried mud from the street, the walls and ceilings are sadly in need of cleansing, and the place usually communicates with the living room, where the stock of bread is being baked, to be afterwards sold in the shop. The place is, in short, an ideal one for the incubation of the micro-organisms which are to be found in such large numbers in milk. Evidently this is not a proper place in which to keep milk for sale. It may be said, however, that you have regulations with penalties attached. I submit that these regulations are impracticable, for it is almost impossible for these people to keep a shop of this kind in which milk would not be contaminated and the multiplication of the existing micro-organisms enormously increased. Furthermore, I do not think that if a case were taken before a bench of magistrates, they would inflict a penalty. The occupiers of these shops, however, sell so small a quantity of milk that they cannot make any appreciable profit, and it would be no hardship to them if they were compelled to give up its

sale altogether. As it is, most of them only sell it to oblige a few customers. This state of things could be remedied by licensing milk-shops, and making it illegal to sell milk in any quantity, however small, in a place not so licensed.

The result would be that dozens of these small shops would cease to supply milk, as they would not be able to comply with the regulations conditional to the license; and in their place would be found properly-constructed dairies, which would amply supply the needs of the district and would be remunerative to the proprietor. Part 3 of the Model Regulations of the Local Government Board with respect to dairies, cowsheds, and milk-shops would be the condition of the license, viz., as to lighting, ventilation, water supply, cleanliness of milk-shops and milk-vessels, and the precautions to be taken against infection or contamination of milk. Penalties would be prescribed for infringing the regulations, and, if necessary, the license could be cancelled.

Refrigeration of the milk should be enforced, and provision should be made against the entrance of organisms from the air. This may be effected if the milk be drawn off, for purpose of sale, by means of a tap, the containing vessel having an air-hole in the top kept plugged with clean cotton wool.

Sterilisation of all milk-vessels by means of steam for an hour, in a suitable steriliser, should also be compulsory. It is not much use, however, attempting to purify the stream if the source is not pure. We must not only endeavour to obtain clean milkshops, but clean cowsheds.

There is no reason why the milk supply of the whole country should not be very much cleaner and purer than at present. What are the conditions under which milk is supplied in many instances? In very many farms the cows are housed in badly constructed, badly lighted, ill-ventilated sheds, the walls of which are thick with dust and fouled with manure, while festoons of cobwebs hang from the roof. The floor is often paved with cobble stones, between which liquid manure drains into the earth beneath; the bedding, which frequently consists of sawdust, is not removed often enough; the more solid manure is allowed to accumulate too long, and the whole place smells foul. The cows' flanks and udders are coated with dried manure, and no attempt is made to cleanse them. I have been told by a farmer that it is no uncommon thing for a farm servant to proceed to milk with soiled clothes and dirty hands, just as he has come from the manure pit. The hands, during the process of milking, become wet, and the filth gets into the milk. It is in this way, probably,

that the various organisms are introduced, as well as from the general dirt and dust of the place. The following extract is from "The Bacteriology of Milk," by Swithinbank and Newman, page 215 (London: John Murray):—"In seven years, 1896–1902, in the City of Liverpool, 1,124 country milks were examined, of which 84 (or 7·4 per cent.) were tuberculous.

"In 1,119 samples of town milk, only 2 per cent. were tuberculous," but that I think can be accounted for by the greater vigilance exercised by urban authorities. The same authorities (page 215) state that "in 1900 and 1901, 509 samples of town milk were examined for *B. coli* and *B. enteritidis sporogenes*, with the result that 126 samples (24·7 per cent.) contained coli, and 30 samples out of 509 (5·8 per cent.) contained *B. enteritidis sporogenes.* During the same two years, 491 samples of country milk were examined, with the result that 218 (or 44·4 per cent.) contained *coli*, and 47 (or 9·6 per cent.) *B. enteritidis.* It will be seen, therefore, that of all the milks examined in Liverpool, more than thrice the number of tubercular samples were found in the country milks, and nearly twice the number of contaminated samples, when judged by the standard of the presence of *B. coli* or *B. enteritidis sporogenes.*" If there were no other reason, I think that these results alone point to the desirability of local authorities having much greater control over the milk supply than at present. Legislation, having for its object the licensing of dairies, cowsheds and milkshops, is the remedy which I would suggest. Such legislation should not be left to local authorities to adopt or not as they are pleased. It should be compulsory for every person occupying a cowshed, dairy, milkshop, or milkstore, and for every milk contractor, to be licensed by the local authority. The license would carry with it certain conditions. Regulations similar to the Model Regulations of the Local Government Board must be complied with, viz., those laid down in Parts I. and II. for prescribing the lighting, ventilation, cleansing, drainage and water supply. Every cow should be tested for the presence of tuberculosis, and branded with a distinguishing mark; a register should be kept of the operation, and provision made which would render it impossible for a rejected cow to be again used for milking purposes in any other locality. No person suffering from phthisis should be allowed to be actively engaged in the occupation of a cow-keeper, dairyman, or purveyor of milk, while so suffering.

Such should be the principal conditions under which the license should be granted. Penalties should be attached for the violation of any of the conditions, and, in extreme cases, the license cancelled. In any case

it should be held for one year only, and at the end of that period renewed if the conduct of the licensee had been satisfactory.

RESOLUTION.

In consideration of the insanitary condition of many dairies, cowsheds, and milkshops, which thereby renders the milk supplied under such insanitary condition unfit for human consumption and dangerous to the public health, this Section is of opinion that legislation is desirable to secure the annual licensing of all Dairies, Cowsheds, and Milkshops in lieu of registration as at present, and that condition of licensing should be that these premises conform in every respect to the local Regulations; and this Section recommends the Council of the Institute to bring the proposition under the notice of the proper authorities.

PROFESSOR KENWOOD (London) was glad to second the resolution, and in doing so would remind the Conference that at present the registration of dairymen is obligatory upon sanitary authorities. The authority had no option in the matter, and were unable to attach any conditions to their registration. It was, moreover, the dairyman who was registered and not the premises. It would certainly be a step in the right direction if all dairies, cowsheds, and milkshops were licensed by the local authority; but he would suggest that the resolution should be amended so as to require an *annual* license, of which we have a precedent in the annual licensing of slaughter-houses provided by the Public Health Acts Amendment Act, 1890. An annual licensing would improve our opportunities each year of securing the maintenance of these premises in a satisfactory sanitary condition. Many sanitary authorities were very backward in availing themselves of the powers which they possessed under the Regulations, and he would suggest that the resolution should be further amended, so as to make the licensing conditional upon the premises fully meeting the requirements of the Regulations in force in the district where the registration is effected. It would be an easy matter then for a supervising authority to bring to account a local authority for not carrying out one of its most important duties. Of course, this condition could not apply to those defaulting authorities who had not adopted any Regulations under the Dairies, Cowsheds, and Milkshops Order. In his opinion further legislation was necessary to require that *every* sanitary authority in the country should make these Regulations; and the county council (and, where necessary, the Local Government Board) should do more than at present to secure the enforcement of these Regulations. He thought the resolution embodied a useful and practical suggestion which would do something to improve existing conditions.

DR. F. T. BOND (Gloucester Combined Districts) proposed to confine the discussion to its strict object, namely, the advantage of licensing as opposed to registration of those engaged in the production or sale of milk. He thought that the strongest ground on which the adoption of licensing could be advocated

was that those engaged in the preparation of meat for sale were required to be licensed, and it was difficult to see why what was proper in the case of mea was not equally proper in that of milk, and he might add bread. On that ground he thought that they had a strong case, and one which it would be very difficult to resist.

Dr. W. G. Savage (Colchester) remarked that it might be supposed that it was the same thing and equally efficacious, to first register and then take action if unsuitable, as to license only if suitable; but as practical administrators they knew there was a huge difference between taking action against a fact, a person registered, and action to prevent a license being given. The point, however, he wished to urge was the advisability of the license not being given annually, but for every *three* years. There would be less opposition, it would be satisfactory for the milk vendor to know that if he did his work in a sanitary way he could not be removed from the register for three years, and above all it would be a more practical procedure. The number of milk vendors was very large, and if they had to be licensed every year there would be a great danger of the licenses being renewed in a perfunctory way and without special investigation. If, on the other hand, they were licensed every three years, only about one third would have to come up each year, and each license would be carefully considered and administrative efficiency would be promoted.

Councillor Ellison (Bootle) said that all towns that got their supply of milk from the country should have power to send an inspector to visit the farm, to see if the cows were kept clean and the necessary air space provided, and that the water supply was good. Cows should not be allowed to drink from pits, stagnant water, or from dirty water sources; and all milk should be put through a refrigerator and properly cooled as soon as it has been taken from the cow.

Mr. R. W. Edwards (London) remarked that it was not very easy for the lay mind to discover from the Acts and Orders in force, as set out in the paper just read, the necessity for further powers in relation to the sale of milk from dairies or milkshops. Indeed, they not only seem sufficient as suggested, but in the case of the City of London they are sufficient. The medical officers' monthly report does not contain a cleaner page than that referring to dairies and milkshops. Month after month numbers of these places are inspected, and the report uniformally reads that the conditions and surroundings are satisfactory. He protested against unnecessary and harassing legislation, and suggested that the existence of the undesirable places referred to in the paper read arose from the fault of the local authorities, medical officers, and inspectors; on the other hand, there could be no doubt that the sources of supply, and the conditions under which milk is supplied wholesale to large towns, require the most serious consideration, and perhaps legislative interference.

The resolution was carried.*

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* Resolutions passed are referred to the Council, and their decision is given on page 606, No. 10.

CERTIFYING NEW HOUSES.

ON THE DESIRABILITY OF FORBIDDING OCCUPATION OF NEW HOUSES UNTIL CERTIFIED TO COMPLY WITH CERTAIN SANITARY CONDITIONS.

By SIDNEY DAVIES, M.A., M.D.Oxon.
(MEMBER.)

THE Public Health Acts have been mainly concerned with nuisances, and the sanitary condition of existing buildings. The Public Health Act, 1875, does, however, provide for the drainage of new buildings, and the Public Health (London) Act not only requires new buildings to have dustbins and w.c.'s, but makes it penal to allow a new house to be occupied until it is certified to have a proper and sufficient water supply.

The sanitary provisions for new houses are mostly contained in the building by-laws, made under the Public Health Act, 1875, and for London in the London Building Act. The latter lays down for habitable rooms a minimum height, and a minimum size and height of window, and further requires ventilation of the floor, concreting the site, and provision of a damp course. The district surveyors are charged with seeing that these provisions are carried out, but they do not give any certificate which indicates that the law has been complied with, and it is therefore easy for any particular requirement to be overlooked. At present it is only with respect to a suitable supply of water that a certificate is required before a habitable house can be occupied, and this condition is only made in London.

There is, however, another precedent for a proposal to certify new houses as complying with certain sanitary conditions. The Customs and Inland Revenue Act provides for exemption from payment of inhabited house duty for a certain class of house if they are certified by the medical officer of health to afford suitable accommodation for each family occupying them, and due provision for their sanitary requirements. Good landlords should certainly be encouraged, but is it expecting too much to ask that *no one* should be allowed to let a house which does not afford suitable accommodation and due provision for sanitary requirements?

It has often occurred in my experience that, in spite of the provisions

of the Building Act, new houses have been built and occupied in which inhabited rooms are insufficiently lighted; w.c.'s are unsatisfactory; the site is not concreted: no proper ventilation is provided; and the houses are damp from absence of a proper damp-course. These deficiencies have been sometimes due to neglect to enforce the Building Act, and sometimes to the fact that the provisions of this Act are insufficient and imperfect. In one case the w.c.'s in a row of houses had been placed under the staircase in such a position that their use was attended with considerable difficulty. In another case, although the windows of certain living rooms were more than the required size, the chief part of the light was obstructed by a bridge which formed the main approach to a block of workmen's dwellings. Houses, which have complied with the Building Act in all respects, are frequently let before the dampness has dried out of the bricks and plaster, causing great injury to the health of the occupants. A row of houses in one street was occupied before the steps to the front door were erected. Anybody who unwittingly stepped out of the front door would have fallen a depth of nine feet.

It seems, therefore, worthy of consideration whether it is not desirable and practicable to enact that *no house shall be occupied until it is certified to comply with certain sanitary conditions; e.g.*, in addition to having a proper and sufficient water supply, *that the habitable rooms are sufficiently lit and ventilated, and that the house is properly protected from dampness; that the walls and floor are dry, and that due provision is made for sanitary conveniences.* There is no doubt that the requirements of such a certificate would be a great advantage from the Public Health point of view.

It is not necessary at present to decide what officer shall give the certificate; this might be left to each district to settle. It might be arranged that the surveyor in the first place should give a certificate that the house complies with the building regulations in force in the district, and the Medical Officer of Health might certify that in other respects the sanitary conditions are satisfactory. If the surveyor charged with the enforcement of the building regulations were required to give a certificate that the sanitary provisions had been carried out, he would no doubt be careful in supervising the plans of the house submitted to him, and in seeing that these provisions were carefully attended to.

If a certificate were refused, the owner should be informed what works were required, and if he was unable or unwilling to do them, he should be allowed an appeal to a police court. If the Court considered that the requirements of the sanitary officer were unreasonable they would

have power to permit the occupation of the house. The Court might also have power to allow occupation of the house in an emergency, but at the same time to make an order that the works required should be carried out.

No doubt there are practical difficulties in the way of the suggested certification, but in the opinion of the writer the advantage to be gained is so clear as to outweigh any possible objection.

RESOLUTION.

That, in the opinion of this Conference, it is desirable that the provisions of the Public Health Acts which prevent occupation of new houses until they have been certified to have a proper water supply, should be extended to include other sanitary requirements.

DR. F. VACHER (Cheshire) supported the resolution, and said that the practice in this matter differed in different districts. In many there was at present no inspection of new houses except as regarded water supply. It happened sometimes that, within a few weeks of a new house being occupied, it was necessary for a nuisance removal notice to be served. In a little book on "Defect in Plumbing and Drainage Work," issued many years since, it is said that some of the most obvious defects were discovered in comparatively new houses, and such defects should have been detected by the local building surveyor before the houses were occupied.

DR. EVANS (Bradford), in seconding the resolution, said that before occupation new dwelling-houses should be suitable in every respect, and especially should the walls be in a reasonably dry condition. He thought that every house before occupation should be certified as fit for the purpose by the medical officer of health. This certification was secured in Bradford by a private Act of Parliament, and in the examination of houses, the medical officer of health was assisted by the building inspectors. When a house builder applied for the certificate of the medical officer of health an examination was made, and on the report of the building inspector, the certificate was either granted or withheld. The owner of any house was held responsible for its occupation, and if it was occupied without the certificate was proceeded against. The system worked well, as house builders gave their co-operation, and prosecutions were rare. Builders when selling new houses, always sold them subject to production of the certificate of the medical officer of health.

The resolution was carried.*

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* Resolutions passed are referred to the Council, and their decision will be given in a subsequent Journal.

MEDICAL OFFICERS OF HEALTH AND INSPECTORS OF NUISANCES.

By Miss CONSTANCE COCHRANE.

(MEMBER.)

IF the satisfactory movement in Parliament and elsewhere in the direction of increased attention being given to the important question of rural housing and sanitation, is to be productive of good, the present most unsatisfactory position of medical officers of health will have to be dealt with.

Many of these are in private practice, and chiefly depend on the fees of those living in their districts, some of whom are the worst offenders against the laws of health. Those who are without private practice are still more or less hindered in promoting reform owing to their position of mere advisers to the rural district councils. If the members of these councils realised the importance of public health questions, and of subordinating private interest to public good, there would be no objection to this arrangement; but those who have had experience of the work of rural district councils will agree that in many of them where there are, say, ten members who realise their responsibility and work for the public good, there are twenty who effectually bar the way to progress. Many of the most conscientious medical officers of health who have taken such appointments have felt themselves obliged to resign them, whilst others who persevered in doing their duty have lost their appointments in consequence. Although some councils are capable of appreciating the warnings and advice of highly educated medical men, the majority cannot be said to do so; and of the existing medical officers, some are compelled against their wills to acquiesce in what they know to be wrong, but are powerless to alter.

That a large amount of public money is at present wasted on salaries of sanitary officials will not be denied by those who judge of the value of work by results; and the fact that such salaries are as a rule mean and inadequate, does not affect the statement.

To persons who have not studied this question, and are inclined to doubt the accuracy of what has been said, I would recommend a perusal of the reports of rural district councils and of the various special inquiries which have been held by the Local Government Board in rural districts during the last few years in consequence of outbreaks of infectious and other diseases, etc. It will probably be argued that such conditions are exceptional, but this is not so; and a detailed description of every rural district in England would reveal in a majority of them a state of things which would greatly shock a public which is now largely indifferent because it does not know the truth, and does not realise that a neglected, unhealthy, and diminishing rural population is both directly and indirectly a serious menace to the stamina and prosperity of the nation, and a cause of moral and physical deterioration, to say nothing of the hardship and injustice inflicted on the individual.

If the care of the public health is to remain in the hands of rural district councils as at present constituted, the only thing to be done will be to multiply sanitary officials and to appoint, at considerable extra expense, responsible supervisors. To quote the words of Mr. Wilson Fox:—

> "I venture to reiterate that until the inspection of cottages is undertaken by the county councils or a Government office, through capable and disinterested officials, influenced by no local prejudices or interests, so long will the housing of the labourers remain a great blot on our rural life."

There is a strong movement requiring that the appointments of medical officers of health shall not be made for a limited period. But is it certain that such mode of tenure would meet the needs of the case? Judging from my own experience of members of the medical profession, I believe that, as a rule, they stand out as amongst the most unselfish, public-spirited, and hard-working of mankind; but they are only human, and it is in human nature, when secure of anything, to cease effort to a certain extent, and to gradually lose interest and energy.

And would it be fair to a clever, capable medical officer to leave him for life in charge of a small rural population, whilst a large and growing district near might be suffering from being under the permanent care of an indifferent officer who had perhaps obtained his appointment through private influence and who took little or no interest in his work? Would it not be better in every way if young medical officers began life in small districts at small salaries, or even if they obtained practical training for a time under good inspectors of nuisances? And after a few years in one district they could be promoted, according to merit, to gradually increasing larger and wider spheres. Unless the appointment were a county one,

a medical officer of health would have a much freer hand if he did not reside too long in the same district.

And most of what has been said applies equally to inspectors of nuisances. Apart from the fact that there are good and bad inspectors, as there are good and bad in all classes and professions, and that it would be hard on a district to saddle it perpetually with an unsatisfactory officer, the work of these officials must always be very difficult, demanding unusual courage and public spirit. Therefore if, by granting non-lapsing appointments, fear of the consequences of doing their duty were removed, vested interests stronger than fear would have been established in their place, such as self-interest, friendship, etc.

If non-lapsing appointments are to be granted, or even without them, inspectors of nuisances should be moved every few years in the same way as the rural police. The objection that the working methods of one inspector might differ from those of his successor, and so cause inconvenience and expense, appears to be less serious than the consequences of a life-long tenure in the same district.

If any such scheme as has been suggested were likely to receive consideration, the appointment of medical officers of health would have to rest with different authorities. Pending the possibility of public health administration being made a department of the Civil Service, how would it be to constitute the Rural District Councils Association the consulting authority as to appointments; these to be submitted to, approved and confirmed by the Local Government Board, or the County Council of the county in which the appointment was to be made? It is probable that the representative men on the Rural District Councils Association are the pick of the rural districts, and they would see more clearly than would a more academic body the need for appointing as sanitary officers men of common sense and practical experience. Members of that association would be unlikely to attach undue importance (for this particular work) to scholarly attainments, and would be careful to select men who had proved by the results of their labours that they were the right men in the right place.

Other issues bearing more or less directly on the responsibility of the nation towards the health of its people are the two questions: whether there ought to be a Minister of Public Health, and whether the appointment of county medical officers of health, with staffs of assistants for local work, should be made compulsory. Anyhow, it is quite certain that, whatever Acts of Parliament are passed, there will be no real reform in

the housing of the people until the question of the position of medical officers of health has been faced.

DR. HERBERT JONES (Hereford) thanked Miss Cochrane for placing so forcibly before the meeting the anomalous position in which medical officers of health in the provinces were placed. He was afraid that the expression security of tenure was a little misleading, and it was thought in some quarters that what they wanted was absolute fixity, however indifferent they might be to the duties imposed upon them. What they really wanted was the abolition of the periodical re-election. They wanted non-lapsing appointments. There was no other public official or private servant who was subject to appointment for a short period, and who might find himself, without a day's notice, deprived of his office. He mentioned two instances in which medical officers of health who had been re-elected year after year for many years only learned from accounts in the local papers that they no longer held office. They had no opportunity for protest, and no reason was given for thus superseding them. We in England were horrified to learn that the medical and other inspectors in Chicago were in the pay of and dismissable by the owners of the stockyards, forgetting or not caring to remember that the majority of medical officers of health and sanitary inspectors in this country held office under the same conditions, and that their continuance in office depended upon the goodwill of those with whom in the course of their work they might come into conflict.

CONGRESS AT BRISTOL.

CONFERENCE OF ENGINEERS AND SURVEYORS.

ADDRESS

By H. PERCY BOULNOIS, M.Inst.C.E.

(FELLOW.)

PRESIDENT OF THE CONFERENCE.

IN the year 1892 I had the honour of occupying the Presidential Chair at a similar Conference to this, at Portsmouth. That Conference was the first of its kind held under the auspices of The Royal Sanitary Institute. and on that occasion I expressed the hope that the experiment might justify repetition in future years. It is evident that my hope was justified, for since that date similar conferences have been held in various towns at all the Congresses of the Institute, and have been largely attended.

There can be no doubt as to the value of such conferences, where we meet to discuss various municipal and other engineering questions which bear so largely on the well-being of our country. Everyone is apt to get into a groove, and it is only by ascertaining what others are doing and by keeping in touch with the daily movements and progress that this is prevented.

At the Conference in 1892 I exhibited a large chart or diagram of the six principal branches of municipal engineering, divided into the various sub-branches under which the work of a municipal engineer is carried out. That chart has since been reproduced, and was largely circulated with, I venture to believe, some advantage to municipal engineers.

Since I prepared this chart in 1892, there have been considerable changes and advances made in many of the branches of engineering to which I then referred, *e.g.*, the much-discussed question of sewage disposal.

Since 1892 great changes in the methods adopted for purification have been made, and the bacterial processes, then only hinted at, have made great progress, though they are still some way off finality. Formerly chemists and engineers were devoting their time and energies to the prevention of the decomposition of the sewage, and many attempts were made and much money was spent in this direction which, unfortunately, in most cases proved to be more or less failures. Now all this has been changed, and that great natural force, decomposition, has been pressed into our service, and, under proper control and guidance, deals with our sewage, purifies the unclean, and restores that great balance of nature, which seems to be an immutable law. This purifying process, however, is not merely a question of the provision of a septic tank, filters and land, which is the popular idea of the solution of the problem, it means much more than this.

There is a large number of questions which requires very careful consideration in designing a scheme of sewage disposal, if it is to be successful. Sewage varies in composition and quantity, not only in different localities but often from day to day, and even from hour to hour.

A scheme which might be very suitable for a residential district where the sewage is of a "domestic" character might be unable to deal with the sewage of a manufacturing town. In the latter case a most careful consideration of the composition of the sewage is necessary, and it might be necessary to call in the aid, and seek the advice, of a bacteriological expert before the engineer proceeds to formulate his scheme.

The quantity of sewage that should be fully dealt with has been provisionally to some extent decided. This may be taken at three times the normal daily dry weather flow (technically known as the D.W.F.) where the sewerage is on the combined system, and twice the D.W.F. where it is on the separate system.

Where the D.W.F. cannot be ascertained by gauging, or where the water supply to the district to be dealt with is not known, the amount of the D.W.F. can only be roughly estimated according to the class of population, and this amount may vary between ten gallons per head per diem, where the population is of the labouring class, and water is not laid into their dwellings, to forty gallons, or even more, in a residential or manufacturing town where there is an unlimited supply of water.

In addition to this, there is often, unfortunately, a considerable influx

of subsoil water into the drains and sewers, especially where they were constructed many years ago, and this upsets calculations, is often very difficult to estimate, and still more difficult to prevent. The quantity of water thus entering the sewers has, however, to be included in the D.W.F.

With regard to the trade effluents from various manufactories where they discharge into the sewers, this further complicates the question, for although it has been decided that one and a tenth of the ascertained trade effluent must be added to the D.W.F., it is very difficult, and sometimes impossible, to ascertain the quantity, especially where a manufactory has its own private water supply, which is generally the case with breweries.

Many trade effluents are of a most refractory character and difficult to deal with, and where they are in large quantities in proportion to the domestic sewage they add very greatly to the difficulty of a proper purification of the sewage. Even when the quantity and composition of the sewage to be dealt with has been ascertained, the question of the best means for dealing with it at the outfall has to be decided. The size of the tank has been so far settled at a capacity of about one to one and a quarter day's volume of the D.W.F., but whether the tank should be covered or open is a matter on which there is still much discussion.

With regard to the treatment of the tank effluent, no final consensus of opinion has yet been arrived at.

Whether "contact bed" or "streaming filters" should be employed is to some extent a question of levels, and whether sufficient fall can be obtained; though the latter process, for small installations, is considered the best, as requiring less skilled attention. With regard to the former process there is also the question of double or single contact which has to be decided, and the question as to what is the best material to be used for filling the beds or filters is to some extent a question of locality and consequent cost, although even with this question there is some diversity of opinion as to which is the best form or size of the material. This is also the case with streaming filters, and the question of the best shape, depth, and means of spreading the effluent has not yet by any means been finally settled.

It would be impossible and out of place, in an address of this description, to go into the details of the various problems with which this question of sewage purification abounds. I have said enough to show that although great strides have been made in this branch of municipal engineering much more remains for solution.

I may, however, refer to other questions with which the municipal engineer has to deal, some of which have advanced since I last had the honour of addressing you, whilst others have not made much progress.

The proper housing of the labouring classes, both in urban and rural districts, is a problem which has not yet been satisfactorily solved. It involves not only engineering but serious economic questions which are not easy of solution.

The employment of the unemployed on municipal works is a somewhat similar problem. It is not an easy matter to find suitable work for the men who swell the ranks of the unemployed, many of them are unfortunately unfit for work, and some of them are what the Germans call "work-shy."

Another question which looms large in our perspective is that of the recent revolution in the description of the locomotion on our roads and streets by the introduction of motor-cars and traction engines, which have entirely altered the character of the traffic which our roads and streets were designed to carry. Whilst, on the other hand, their surfaces will not be subjected to the hard hammering of the horses' hoofs, they will be subject to a tearing, disintegrating action from the rapidly revolving pneumatic tyres of the motor-car, and to greatly increased weight of the traction engine and its accompanying loads.

Not only is this question one of future construction and maintenance of our roads and streets, but there is also the question of the dust raised by this rapid locomotion, which is becoming a terrible nuisance throughout the country, and must be stopped before serious damage thereby is caused to persons and to property.

Whilst on the subject of our streets, it may be well to call attention to the question which is now being raised in many quarters as to whether the rigid tram line and inelastic traffic of the tramcar is suitable for our crowded streets, and whether the motor omnibus is not a more suitable substitute for the conveyance of the increasing traffic.

With regard to the supply and distribution of water, the question of the economical supply of pure water to our villages and scattered houses is worthy of every engineer's attention, as such supplies are required all over the country. Unfortunately, the cost is generally prohibitive, or a local source of water supply is only available by pumping, involving such an outlay and annual cost as is beyond the means of the district.

The various types of wind engine, which were introduced as a cheap means of pumping water, have not met with the success that was at one

time hoped for them, chiefly owing to the uncertainty of the velocity of the wind in this country.

There have been some improvements in pumping water since 1892, notably the introduction of the air lift, whereby it has been made possible to raise more water from deep wells, especially in bores of small diameter, at a reduction in cost.

The manufacture of special jute-covered steel tubes for water mains has, under certain conditions, tended to lessen the cost of the distribution of water where these tubes can be used instead of the ordinary cast iron pipes, but hitherto it has been found that they are not suitable for service mains, where they have to be tapped with ferrules for house services. For long lengths of sealed mains they can be laid with advantage, especially where there is any risk of ground subsidence.

Concrete construction has made considerable progress since 1892, due to the introduction of the Hennebique patent processes, and there is, no doubt, a large field open for this description of construction in many branches of engineering. The strengths obtained by this fortified concrete have been remarkable, and it looks as if our text-books on the strength of this material will have to be revised.

With regard to some of the minor questions with which you are constantly dealing: a discussion has again lately been revived as to whether the house drain should or should not be trapped before it enters the sewer, and there seems to be considerable divergence of opinion on the matter.

Street lighting has made great strides since 1892. The introduction of the Welsbach and other gas mantles has given a great impetus to gas lighting, and although an improved electric arc lamp has been lately introduced, gas lighting, for the present, seems to hold its own, in street lighting, where properly and scientifically carried out. There are, no doubt, still further developments to be made both with gas and electricity for lighting and heating purposes.

With regard to the disposal of house refuse, there have been some improvements in the construction of destructors, whereby the gases are more thoroughly consumed, and we hear less of nuisances caused in the neighbourhood of these very necessary installations than was formerly the case.

With regard to public baths, an improvement has lately been introduced, whereby the water in a swimming bath can be filtered at a very small cost, so that the same water is used over and over again; this greatly

reduces the cost of water, and also renders the water in the bath always bright, clear and more attractive on every day of the week, instead of allowing it to get dirty and discoloured before it is changed, which is the general practice.

I have endeavoured in this short address to draw attention to some of the questions in which you are all interested, and in which you all have to take a part in forming the real history of a country.

Progress is the watchword of every engineer, and it is especially so with the municipal engineer, as the eyes of the public are so constantly upon him, and he is subject to much criticism.

There is no finality in engineering, and it behoves us, who have the well-being of the country at heart, to take advantage of everything that will help us to meet the difficulties which must ensue from the modern desire of the human race to aggregate together in large centres of population. I trust that this conference may assist in the discussion and, perhaps, elucidation of some of the engineering problems that are now so prominently before the public.

DESIGN OF WORKS FOR BACTERIAL TREATMENT OF SEWAGE.

By J. S. PICKERING, M.Inst.C.E.,
Borough Engineer, Cheltenham.

(MEMBER.)

IN designing works for the purification of sewage one of the first points to be settled is the volume to be treated at the works. The Local Government Board usually require provision to be made for dealing with at least six times the dry-weather flow apparently on the fairly safe assumption that sewage diluted to a greater extent than this may, as a rule, be discharged into a water-course without causing serious pollution. It must not be overlooked, however, that when heavy rain occurs between the periods of average and maximum flow the intended degree of dilution will not be reached unless the overflow arrangements are adjusted to the varying flow of sewage. It is therefore important to have a properly designed overflow. The ordinary fixed weir will, with a heavy head of storm-water, permit an excessive volume to pass to the works, and the type known as the leap-weir is also unsatisfactory. A type of storm-water overflow not generally known, but far in advance of the usual forms adopted, is one having a separating plate fixed horizontally at weir level across the sewer, the quantity to be treated passes underneath this plate, and all in excess is deflected by a vertical plate into the overflow culvert. A description and illustration of this is given in a paper recently read before the Institution of Civil Engineers by Mr. D. E. Lloyd Davies, Assoc.M.Inst.C.E. But no storm-water overflow which does not take into account the fluctuating dry-weather flow of sewage can be considered entirely satisfactory. The overflow should be capable of adjusting itself to the varying flow in the sewer, so that it would always come into operation when the proper degree of dilution was reached.

Not infrequently paper and other floating matter pass over the

storm-overflow weir, and some means should be adopted for preventing such objectionable matter from entering the water-course.

The works of purification may be conveniently described under the following heads:—Screens, detritus tanks, sedimentation or septic tanks, filters, and land.

Before considering in detail these various sections of the works, reference may be made to the accompanying tables. Through the courtesy of the engineers and managers, the author has been able to tabulate detailed information from nearly a hundred works where the bacterial system is in operation. With the object of showing the extremely divergent opinions which exist with regard to the capacity and design of works for the bacterial treatment of sewage, summaries are given of the replies to a few of the most important questions from forty towns, twenty of which have contact beds, twenty continuous filters, and nearly all detritus and septic tanks. Even where almost identical conditions prevail the practice of different engineers is so much at variance as to lead one to the only possible conclusion that, in many points of detail, the bacterial treatment of sewage has by no means passed the experimental stage.

It is necessary that the sewage should be screened upon entering the works. The design of the screens will depend somewhat upon the character of the sewage and its subsequent treatment. Except in very small works, it is desirable to have the screen in duplicate, so that the sewage may occasionally be diverted from one in order to thoroughly clean it. As a rule, screens having inclined bars placed three quarters of an inch apart will be sufficient. Screens having mechanical rakes may sometimes be adopted in the larger works with advantage, particularly where the outfall sewer is deep and wide fixed screens would involve a costly chamber, or where motive power is available. Revolving screens may also be found useful in some cases, especially where a head of sewage can be utilised for driving them. But simple hand-raked screens should be provided wherever they can be conveniently applied. Considering the importance of keeping a free discharge of sewage and the desirability of minimising the labour in raking, it is surprising to find screens in many cases only from twice to three times the width of the outfall sewer, especially as screens of adequate width and area can always be provided at comparatively trifling cost. The author suggests that where shallow screens to be raked by hand are provided, the total width should not be less than 9 inches per 1,000 population dealt with, with a minimum of, say, 5 feet. Thus for the discharge from a population of 20,000 the total width would be 15 feet, and for a population of 60,000, 45 feet.

All road detritus and other mineral matter should, as far as practicable, be intercepted in properly designed tanks. There is very little reliable information available as to the quantity of mineral matter which may be expected in relation to the flow of sewage, probably on account of the varying conditions which prevail. It will be noticed that the capacities given in the tables vary from a few minutes to eighteen hours' dry-weather flow, thus indicating no uniformity of practice. Tanks of a larger capacity than two hours generally retain too much sludge in addition to detritus, and in the author's opinion one hour's capacity is sufficient if the septic or sedimentation tanks are so designed that the sludge may easily be removed therefrom periodically. The interception of organic matter in suspension along with the detritus is a decided disadvantage, as this can be better dealt with at a later stage of the treatment. Moreover, it renders the removal of the detritus an offensive operation. To bring about the separation, the sewage in its passage through the tanks should be slightly agitated. It has been found in practice that with a flow of about a million gallons per day it is possible to agitate the sewage sufficiently with hand rakes to effect this separation, but it would be preferable to rely upon some mechanical means of agitation where possible. In large works, where the detritus is sometimes brought to the surface in buckets on an endless chain, organic matter is generally lifted along with the detritus, and in this state its disposal often gives rise to a nuisance.

Having freed the sewage of the greater part of the mineral matter, some form of tank treatment is necessary prior to its application to filter beds. The opinion once freely expressed that the introduction of the septic tank would practically solve the problem of the disposal of sludge is now fully recognized as being erroneous, and a closer acquaintance with the tank has shown that its merits have been somewhat exaggerated. It cannot be denied that a considerable quantity of sludge is liquefied by the use of the septic tank, and its disposal is thus somewhat simplified. The one serious objection to the septic treatment of sewage is the offensive smell which is necessarily produced by a process depending for its success upon the fermentation or putrefaction of the sewage. This objection applies especially to the use of open septic tanks, the treatment in which cannot be carried on continuously without a nuisance. The author has visited numerous installations where open septic tanks are adopted, and in no single instance has he found works free from the objectionable odour due to the septic treatment.

It is generally recognized that the expense of covering in large tanks

is not justified by the slightly increased liquefaction of the solids obtained, and this is no doubt the reason why the tanks are left open. But the author is of opinion that if septic treatment is to be carried out with the least possible offence the tanks should be covered and thoroughly ventilated, preferably by mechanical means.

It might reasonably be expected that reliable returns from nearly a hundred towns as to the capacities of septic tanks adopted, particularly with regard to new works, would afford some useful data in the design of similar works, but the typical examples which are given in the two tables attached, shew the wide difference of opinion existing with regard to so important a feature of the treatment, and it would certainly be interesting to learn on what considerations these various capacities were based.

Before determining the size of the tanks it is necessary to decide to what extent they will be required to act as septic tanks. It may be taken roughly that tanks of a sufficient capacity to contain a day's dry-weather flow will liquefy about 50 per cent. of the organic solids, and it is questionable whether by doubling, or even trebling their capacity a further 25 per cent. will be liquefied. On these grounds the expense of the additional capacity would not be justified by the comparatively small advantage in the results. Indeed, in the author's opinion it is questionable whether it is either necessary or desirable for sewage to undergo a special septic treatment prior to its application to bacteria beds. Possibly some slight septic action in the tanks may be helpful in the subsequent treatment, but the practice of allowing the sewage to putrify to such an extent as to cause the surrounding atmosphere to be grossly polluted, whatever may be the advantages of such a treatment as regards liquefaction and preparation for the filter beds, is highly objectionable from a sanitary and æsthetic point of view.

Provided suitable arrangements are made for removing some of the deposited sludge at frequent intervals, tanks of a capacity of three-fourths the dry-weather flow should be of ample size to effect the clarification and give any necessary septic action to the sewage, and probably in most cases a much smaller tank capacity would be sufficient.

The means for the removal of sludge from sedimentation or septic tanks call for careful consideration in the design of the tanks. It is now practically agreed that it is necessary to remove sludge from the tanks at shorter or longer intervals. In the accompanying tables the intervals vary from two days to three years. At the best it is an offensive operation, and after drawing off the liquid it is very objectionable to have to raise the sludge from the bottom for conveyance from the tanks. The

practice of placing a number of valves at either end of the tanks is not likely to prove effective, and, indeed, the author is not aware of any arrangement which has been successfully adopted for the removal of sludge from rectangular tanks.

In a scheme about to be carried out by the author it is proposed to build a cross wall 18 feet from the inlet end of each tank and to fix in each of the rectangular spaces so provided two helical scrapers (actuated from a spindle passing through the roof) which will traverse practically the whole area of the floors and convey the sludge to an outlet placed immediately under each spindle, whence it will gravitate through a discharge pipe. It is hoped that, by intercepting the bulk of the sludge in these chambers and removing it from time to time, it may not be necessary to empty the whole contents of the tanks more than two or three times a year.

Before leaving the consideration of septic tanks mention may here be made of Mr. Dibdin's experiments in substituting slate beds for the usual preliminary tank treatment. By this method of aerobic bacterial treatment immunity from nuisance is claimed, and if its satisfactory application on a large scale can be demonstrated (which is somewhat doubtful) a decided advance in the sewage problem will have been made.

The question as to whether the tank effluent should be dealt with in contact beds or continuous filters depends largely upon the levels of the site and other local conditions.

Broadly speaking the effluent from a percolation filter 6 feet deep is equal in its standard of purification to an effluent of the same quality sewage from a double-contact system.

The practice of the Local Government Board is to require the same capacity to be provided for percolation filters as for single contact beds, and if a second contact is provided at least half as much again and possibly twice as much filtering material is required. When the system was first introduced eminent authorities on the subject expressed the opinion that contact beds after being in use a comparatively brief space of time would acquire a practically constant capacity. Experience has not confirmed this sanguine view, and it is now generally recognised that the material must be sifted or washed from time to time to restore the liquid capacity.

The life of a percolation filter is undoubtedly much longer than that of a contact bed. Percolation beds which have been in use for several years shew no reduction in treating capacity. They are in a measure self-cleansing. The substance which clogs the interstices of a contact bed

either passes through a percolation bed with the effluent or may be readily washed through. A system of percolation filters will be as a rule much more economical, both in initial outlay and working expenses, than a system of double-contact beds.

Nothing need be said on the design and management of contact beds, as their construction and method of working are comparatively simple: points decidedly in their favour as compared with continuous filters.

There are many matters requiring consideration in designing percolation filters and details of construction are still the subject of controversy.

Although it is customary to build the filters with perforated walls above ground level, it has not been demonstrated in practice that this method of construction produces better results than in the case of filters having closed walls or merely earth embankments.

The permanent success of a filter depends largely upon the use of a suitable filtering medium and too much care cannot be exercised in making a selection. Materials liable to disintegration such as coke, ashes, and burnt ballast should be avoided. Blast furnace slag requires experience in its selection. It has been found satisfactory in most cases, but in some instances it has not been a success. Hard furnace clinker is generally looked upon as one of the most suitable materials, and provided it can be obtained of a sufficiently durable character, will no doubt be found satisfactory. Remarkably good results have been obtained by the use of hard coal. Coarse gravel, although generally durable, does not produce so good an effluent as most other material broken to the same size. Fine gravel, however, gives much better results. The author is of opinion that a very hard angular material such as broken granite will prove the most advantageous for use, notwithstanding that its initial cost may be somewhat high. It should be remembered that repayment of the loan for the material usually extends to 30 years, and any replacement during this period must be paid for out of revenue; hence the desirability of providing a material likely to last during the period of the loan.

The size of material for the beds is a matter on which a great difference of opinion still exists. A glance at the table of returns (pp. 652–3) will shew this. Examples may be given of two of the largest installations in the country. In one case the filtering material has been carefully sieved and graded to sizes varying from $\frac{1}{16}$ inch to 1 inch, and in the other any size between $1\frac{1}{2}$ and 6 inches has been used. The probability is that the finer filter will give the greater degree of purification, but there is a tendency to ponding on the surface with so fine a material, and it is questionable whether it will be found entirely satisfactory in

		1	2	3	4	5	6	7
1	Dry-weather flow in galls.	550,000	500,000	100,000	120,000	2,500,000	520,000	500,000
2	Character of Sewage.	Domestic	Mixed	Domestic	Chiefly Domestic	Chiefly Domestic	Mixed	Chiefly Domestic
3	Sewers on Separate or Combined system.	Both	Separate	Separate	Combined	Separate	Both	Separate
4	D.W.F. Volumes treated per 24 hours.	Twice	3 times	3 times	3 times	3 times	Under 3 times	Under 3 times
5	Total capacity of Detritus tanks relative to D.W.F.	0·04	0·19	0·75	—	0·13	0·005	0·007
6	Intervals between cleaning of Detritus tanks.	6 months	When necessary	3 and 6 months	1 week	3 weeks	Daily	Weekly
7	Detritus tanks covered or open.	Open	Covered	Open	Open	Open	Open	Covered
8	Total capacity of Septic tanks relative to D.W.F.	—	3·50	7·19	1·23	1·01	0·12	0·78
9	Intervals between cleaning of Septic tanks.	—	1½ years	5 months	3 months	4 months, one 12 mths.	2 months	6 months
10	Septic tanks covered or open.	—	Covered	Open	Covered	1 covered, others open	Covered	Covered
11	Galls. (D.W.F.) per 24 hrs. per cubic yard of material in Contact beds.	56	197	20	27	27	221	104
12	Treatment of sewage after Contact beds.	—	—	On land	—	—	Clay land	—
13	Method of treating Storm-water.	On land and through streaming filter	—	Storm tanks	Contact bed	Storm beds	—	—

EXTRACTS FROM PARTICULARS RETURNED BY ENGINEE[…]

		1	2	3	4	5	6	7
1	Dry-weather flow in galls.	100,000	200,000	57,500	800,000	1,000,000	220,000	4,950,000
2	Character of Sewage.	Domestic	Chiefly domestic	Domestic	Domestic	Domestic	Domestic	Domestic
3	Combined or Separate system.	Both	Combined	Combined	Both	Both	Separate	Combined
4	D.W.F. Volumes treated per 24 hours.	3 times	—	5 times	3 times	3 times	Twice	3 times
5	Capacity of Detritus tanks relative to D.W.F.	0·19	—	0·007	0·023	0·003	0·12	0·07
6	Intervals between cleaning of Detritus tanks.	3 months	3 years	Frequently	—	Daily	—	—
7	Detritus tanks covered or open.	Open	Open	Open	Open	Open	Covered (corrugated iron)	Open
8	Total Septic tank capacity relative to D.W.F.	0·87	0·87	0·35	1·76	—	0·39	0·87
9	Intervals between cleaning of Septic tanks.	12 months	No sludge removed	3 months	—	—	—	—
10	Septic tanks covered or open.	Open	Open	Open	Open	—	Covered (corrugated iron)	Open
11	Galls. (D.W.F.) per 24 hrs. per cubic yd. of material in Percolation beds.	86	124	483	27	137	85	140
12	Method of Distribution	Rotary	Fixed distributors	Rotary	Rotary	Rotary	Rotary	Rotary
13	Kind of material in beds	Clinker	Various	Clinker	Saggers (Pottery refuse)	Clinker	Clinker	Clinker
14	Size of material	¼ in. to 3 in.	1/16 in. to 4 in.	1 in.	¼ in. to 1 in.	¾ in. & over	¼ in. to 1¼ in.	1½ in. to 6 in.
15	Disposal of Sewage after Percolation beds.	—	—	—	—	Through tank	Gravel land	—
16	Method of treating storm-water.	—	On land	—	Streaming filters	Streaming filters	On land	Storm-beds

11	12	13	14	15	16	17	18	19	20
1,520,000	900,000	380,000	18,000	180,000	650,000	550,000	36,770	1,200,000	3,000,000
Mixed	Mixed	Chiefly Domestic	Chiefly Domestic	Mixed	Domestic	Chiefly Domestic	Domestic	Chiefly Domestic	Chiefly Domestic
Separate	Both	Combined	Separate	Combined	Separate	Separate	Both	Separate	Combined
Under 3 times	3 times	Twice	Under 3 times	3 times	3 times	Under 3 times	Under 3 times	Twice	3 times
—	0·16	0·15	0·026	—	0·57	0·09	0·29	0·083	0·027
—	Twice a week	4 weeks	2 days	5 days	When necessary	—	—	—	—
—	Covered	Open	Open	Open	Open	Cover'd (corrugat'd iron)	Open	Open	Open
1·18	—	—	1·20	—	—	—	1·95	0·68	—
2 days	—	—	3 months	—	—	—	2 years	4 to 8 weeks	—
—	—	—	Open	—	—	—	Covered	Open	—
57	42	38	40	6	26	—	53	50	51
On loamy, sandy land	On land (gravel and sand)	—	—	—	Clay land	—	—	On land	—
—	Storm beds	—	Storm filter	Land and contact beds	Storm filter	—	—	Land and Contact beds	—

CTERIAL TREATMENT WORKS *with Percolation Beds.*

11	12	13	14	15	16	17	18	19	20
40,000	600,000	1,000,000	180,000	8,000,000	2,000,000	63,000	150,000	600,000	582,000
Domestic	Chiefly domestic	Chiefly domestic	Mixed	Mixed	Domestic	Mixed	Domestic	Chiefly domestic	Domestic
Separate	Combined	Both	Combined	Combined	Both	Both	Both	Separate	Combined
3 times	3 times	3 times	3 times	4 times	3 times	—	Twice	3 times	—
0·04	—	0·32	0·11	0·15	—	0·21	0·40	0·21	0·032
Weekly	—	4 months	5 days	Twice weekly	2 weeks	17 months	4 weeks	12 months	2 weeks
Open	—	Open	Open	Open	Open	Open	Open	2 open 1 covered	Open
0·73	2·26	—	—	—	0·44	1·58	0·50	0·035	0·82
Over 6 months	2 years	—	—	—	4 weeks	15 months	16 months	3 years	2 years
Covered	Open	—	—	—	Open	Open	Open	Open	Open
56	34	65	170	142	400	123	203	350	89
Rotary	Rotary	Rotary	Rotary	Fixed distributors	Rotary	Rotary	Rotary	Rotary	Rotary
Clinker and brickbat	Coke and Clinker	Coke and clinker	Gas coke	Clinker and hard cinders	Clinker	Blast furnace slag	Clinker	Various	Clinker and broken brick
½ in. to 3 in.	¼ in. to 6 in.	⅜ in. to 4 in.	1½ in.	$\frac{3}{16}$ in. to ⅜ in.	3 in. to 6 in.	¼ in. to 4 in.	1 in. to 3 in.	⅛ in. to 3 in.	¼ in. to 4 in.
Clay land	Sedimentation tanks	Heavy clay land	Through tank	—	—	Fine bed	On land	Catch-pits	—
Storm-bed	—	On land	—	—	—	—	On land	—	—

practice. The nature of the material must to some extent be considered in deciding upon the size to adopt. For instance, a material not liable to disintegration may be used much finer than one of a friable character. There is unfortunately very little information available on the relative results of various sized materials, and until this is forthcoming it is difficult to arrive at a satisfactory conclusion.

Several methods have been adopted for distributing the sewage over the filters, but the two most important need only be mentioned, fixed sprinklers and rotary distributors, the others being modifications of these.

The system of spraying through fixed jets of suitable design gives perhaps the most even distribution, and consequently the best results, but it is open to the serious objection that it cannot be carried out without great nuisance, particularly where the sewage sprayed is from a septic tank.

Rotary distributors are less objectionable in this respect. They have been much improved of late, and from the several different types now manufactured there should be no difficulty in selecting one which with ordinary attention will be fairly reliable. It is not advisable to adopt rotary distributors for beds much over 100 feet in diameter unless electric motors or other motive power is provided.

Dosing tanks become a necessity where the flow of sewage is both small and irregular, but it is questionable whether the additional expense of mechanical arrangements is justifiable, on the grounds that by applying the sewage intermittently better effluents will result.

A considerable quantity of suspended matter is generally contained in the effluent from percolation filters, and where there is no land treatment following, it is somewhat difficult to deal with. It is of so light a character that it cannot be readily precipitated in catchpits, and the best method of dealing with it is to pass the effluent through a shallow filter composed of sand or other suitable material. A coating of what appears like a rich soil will be formed on the filter, and this can be easily skimmed off.

The usual streaming filters for the treatment of storm-water at the rate of 500 gallons per cubic yard per day do not effect any great degree of purification, and it is preferable to deal with storm-water on land, where available.

Great hopes were at one time entertained that the Royal Commission appointed eight years ago to deal with the subject of sewage purification would bring forward a final and satisfactory solution, but so far it has not been forthcoming, though some useful information may be obtained from

the various reports issued. What appears to be required is a properly organised state department, which would collect reliable information from works in operation and conduct trials and experiments at the expense of the nation for the guidance of sanitary authorities, who are now left to their own resources to find a solution of the sewage problem.

MR. THOMAS READER SMITH (Kettering) said he wished particularly to draw attention to overflow weirs, sewage screens, and detritus tanks. He had visited many works, and frequently noted the inadequate provision made for diversion of excess water in time of storm. The Local Government Board required the full treatment of three times the dry-weather flow, or twice if separate drainage for storm-water were provided; and it was most important that the tanks and filters, or other works provided for this purpose, should be protected from being overcharged with storm-water. He was considering arrangements for a dry-weather flow of 750,000 gallons per day, or a full treatment for a flow at the rate of 1,500,000 gallons per day, which meant a depth of flow of about 5½ ins. on a 2 ft. 6 in. weir. Of course, if the overflow for storm-water were only about the same width, the works might easily receive more than double the maximum quantity they would be laid out to deal with, and he had come to the conclusion that it would take a weir 100 ft. long to adequately protect the works from being overcharged. In this particular case it was also important to prevent sewage from backing up the outfall sewer, and a long weir would effect this by giving immediate relief, as it was not likely that any storm would exceed an inch flow over a 100 ft. weir. The gauging weir for the flow to the works might also have a bar across it, so that when the maximum flow to the works was reached, any increase in depth of flow over the gauge would be obstructed by the bar, and some compensation for the extra pressure at the gauging weir obtained from the contraction at the edge of the bar as the sewage passed under. He did not agree that screens were necessary, and thought a detritus tank could be so arranged that screens could be dispensed with, and the overflow weir could readily be combined with it. In the case referred to he would suggest a tank 50 ft. long, divided into two by a channel down the middle, the tanks to overflow into the channel, each side forming a weir 50 ft. long, making a total of 100 ft. The tanks could be worked alternately or together as desired. The entrances to and exits from the tanks, and also the approach to the overflow weirs, might be arranged on the septic tank method so that no floating materials would pass with the flow but would be trapped. In this way everything would be dealt with; heavy materials would fall to the bottom, floating materials would be arrested on the surface, and all could be removed at suitable intervals; also the whole works would be protected, not only tanks and filters, but also any filters or land provided for storm-water which was very

desirable, as otherwise a good deal of material got on to storm beds that they were not intended to deal with. Screens were objectionable in several ways; they were expensive to work, and almost impossible to work satisfactorily when variations in level had to be avoided, as when the available fall through the works was very small; also much that they would stop would, if allowed to pass on, be effectually dealt with by the septic tank. The great diversity remarked in the tank capacities provided at works was very evident in the tables prepared by the author; but from what he had observed in visiting works, he thought a capacity equal to the daily dry-weather flow was a good standard to adopt to provide for future contingencies. As to the construction of percolation beds, some were constructed of very coarse filling throughout, and appeared to allow a good deal of black material to be washed through, which spoilt the effluent. This was a difficulty; but it appeared from experience at Birmingham and elsewhere that the light flocculent material contained in tank effluent might be considerably reduced by passing it through circular upward-flow tanks, and he also thought that finer material on the surface of the filter-beds would prevent a further quantity from entering the beds, and so provide less material to be washed through. The fine material would probably require removing from time to time, but the result might well be worth the small expense entailed.

Mr. G. William Lacey (Oswestry) agreed that finality was by no means yet reached, and hoped that the final report of the Royal Commission would assist them in determining to some extent which was the best of the various systems of sewage disposal. He could hardly see how one could agree with Mr. Pickering's requirements for screens, as with a width of 9 inches per 1,000 population they would get something very unwieldy when dealing with large populations. A good deal depended on the distance the sewage had to flow, for if it flowed a mile or two they did not find much to screen when it got to the works. Reference had been made to the nuisance arising from open septic tanks. He had been over works where they were in operation, and undoubtedly there was an odour, but he did not think it was sufficient to give rise to a nuisance beyond the immediate proximity of the works. The method of dealing with the sludge was one of the important points with regard to the disposal of sewage. If they removed the sludge at frequent intervals they could do with a smaller sedimentation capacity; but should they run the tanks for a period of two or three years, as appeared to be done successfully in some cases? It depended a great deal on the convenience there was for the disposal of the sludge, and it was a matter which was not yet mastered. With regard to percolating filters there was, no doubt, a certain amount of fine material which came away with the effluent, and that would be greater in quantity if the filter medium was large. He had been told that a layer of finer material in the bed would tend to arrest this. Mr. Pickering said that a system of percolating filters would be more economical than a system of double contact beds, and in the next paragraph he went on to say

that the construction and working of contact beds was comparatively simple, points decidedly in their favour as compared with continuous filters. It seemed to him that they required to be more careful, if anything, with contact beds than with continuous filters, and that these were quite as simple in operation as contact beds. From the information given in the returns gathered by Mr. Pickering, the consensus of opinion appeared to be in favour of percolating beds. It seemed that the general view taken was that the percolation bed afforded the best results, and that there was not the same difficulty in clogging as in the contact beds.

MR. E. GEO. MAWBEY (Leicester) said that the suggestion to abolish screens must be taken with great caution. In large pumping schemes, for instance, screens were indispensable, otherwise all sorts of solid matters would reach the pumps and block up and damage the valves. Screens also enabled the detection of undesirable substances passed into the sewers.

MR. JAMES LEMON (Southampton) said he wished to endorse the views of Mr. Mawbey. In a pumping scheme, it was impossible to do without screens, in order to arrest the various articles which came down the sewers, and so prevent serious injury to the pumps. The object in providing small detritus chambers was to retain the heavy matter in suspension. They could be frequently emptied, and thus give less work for the settling tanks. In his practice, he designed the settling tank in three compartments, so that one, or two, could be used according to the various amount of flow therein. Engineers have now got beyond the opinion that bacteria were such wonderful organisms, that they would dispose of sand and powdered granite. It is now recognised that the tanks must be occasionally cleared of the deposit. As to a State Department to advise local authorities, he said it was undesirable. He saw no objection to their compiling information for their use, but there the State should stop. Local authorities must work out their own salvation, according to the varying local circumstances and conditions.

CONSTRUCTION AND MAINTENANCE OF RURAL ROADS.

By ROBERT PHILLIPS, A.M.Inst.C.E.,
County Surveyor, Gloucestershire.
(MEMBER.)

IN this short paper it is proposed to give the personal experience of the writer in constructing some thirty-five miles of road in England, and in the direct maintenance for the past seventeen years of one thousand and fifty miles of county main roads.

CONSTRUCTION.

The ideal road is in a straight line, but this is not often attainable. If the road is to be properly drained, no part of it should be absolutely level. The least gradient should be 1 in 400 (for drainage purposes), and the steepest 1 in 9; 1 in 30 being the most suitable, being the angle on which a wheeled vehicle will stand alone.

Experience has shown that a metalled surface of 18 feet broad is required for rural roads (main), and a width of 40 feet between the fences, and that in the neighbourhood of large towns these dimensions should be increased to 30 and 60 feet respectively. *The law allows vehicles 9 feet in width to travel on the highways.*

The construction of the road will depend on the material available in the neighbourhood. If hard clinkers or refuse from a destructor is to be used, this will require to be 12 inches in depth, and to be well rolled before the broken top metal is applied. The road bed should be 20 inches below the finished surface of the road, and should be curved to give a fall of 6 to 9 inches from the centre to the sides: where possible the finished road surface should be kept above the level of the adjoining land.

If any bog, springs, or running sand is found below the road bed, it should be excavated, and 12 inches of clay puddle placed over it. If a troublesome yellow clay, that is sometimes found between the coal measures and the limestone, it should be trenched across every three yards, two feet deep, and the trenches filled with ashes.

Where the road is in cutting there should be at least a yard of levelled surface between the metalled surface and the toe of the slope.

The top metal should be of hard broken stone, not more than 2½ inches in its longest dimension, spread from the shovel, to give an even surface of about 1 in 30 from the centre, 4 inches thick: this will require one ton to every 8 square yards superficial; and when consolidated the top metal will be 3 inches in thickness. In all cases of thick coating, a profile mould should be used to obtain a good cross section.

MACADAM'S MODE OF CONSTRUCTION.

Briefly it is this, 12 inches of broken stone, the largest stone 6 ounces in weight. No blindage, the road bed to have a curvature of only 3 inches.

Macadam, following Edgeworth and others, advocated no bottoming: the material to be of the same quality throughout.

His theory that the stones would bind by the interlocking of their own angles, is a very pretty theory, but in fact, when the stones had to be rolled in by the cart wheels, the binding material was supplied by abrasion during the process of consolidation.

The modern construction of Macadam roads is cheaper, but not so good. The bottom 8 inches is of an inferior metal; crop stone from limestone quarries, slag, any inferior stone is carted and tipped on the road, and broken down with a sledge hammer, and some gravel or ashes spread to fill the interstices; on this is spread 4 inches of the hard top road metal, which is watered, blinded, and steam rolled.

There is another variation of the Macadam plan, known as *Machine Crusher Road Stone* Roads. This method is to construct the road in three thicknesses. The lowest layer to be 6 inches thick of machine broken stone, no stone to be more than 3 inches or less than half an inch in size; this layer to be watered and steam rolled till consolidated like a finished road, the material for this bottom layer may be inferior limestone. On this a second layer 3 inches thick; no stone in this to be more than 1½ inches or less than half an inch in size, and consolidated as before. The third layer to be 2 inches thick, no stone to be more than 1 inch or less than one-eighth of an inch in size. The whole to be watered and consolidated by a steam roller.

TELFORD'S MODE OF CONSTRUCTION.

The following is a copy of his specification:—

"The metalling is to consist of two beds, or layers; that is to say, a bottom course of stones, each 7 inches in depth, to be carefully set by the

hand with broadest end downwards, all cross-bonded or jointed, and no stone to be more than 3 inches wide on the top. These stones may be of good whin-stone, lime-stone, or hard free-stone, the vacuities between the said stone to be carefully filled up with smaller stones, packed by hand, so as to bring the whole to an even and firm surface.

"The top course or bed is to be 7 inches in depth, to consist of properly broken stones, none to exceed 6 ozs. in weight, and each to pass through a circular ring 2½ inches in diameter in their largest dimensions. These stones to be of hard whin-stone, the quality of both bottom and top metal to be determined by the inspector. In every 100 yards in length on each side of the road, upon an average, there is to be a small drain from the bed of the bottom layer to the outside ditch, as shall be directed by the inspector.

"Over the upper bed or course of metal there is to be a binding of gravel, of 1 inch in thickness on an average. In the cross section of the finished roadway there is to be a curvature of 6 inches in the middle 18 feet, and from that on each side a declivity, at the rate of half-an-inch in a foot, to within 18 inches of the fences. In the remaining space of 18 inches there is to be a curvature of 3 inches, making in all about 9 inches on each side below the finished roadway."

The advantages of this system are that, though you want skilled workmen to pitch the bottom, you can use a material that you could not use in the other system for the bottom (even sand-stone, that is unsuitable for road metal), and if the stones are securely wedged with spauls, they will not work up through the top metal.

The writer has used this mode of construction with a 6-inch bottoming and 4 inches of 2½ inch broken basalt, rolled and consolidated to 3 inches, making a total of 9 inches, on roads carrying heavy traffic. If properly done, this is by far the quickest way of making a road, and is less costly in repairs for the first few months after construction.

Drainage.

This is a fresh problem on every chain of road; the contour of the country, the position of streams or ditches for the outfall must be considered. The use of pipes has become general, but the old square road drains with cever stones and open ditches are preferable, as they are easily repaired by the roadmen.

Side Channels.—No road should be left without a water-table and a raised margin at the side from 4 to 6 inches high. This can be formed in rural districts by turf in two thicknesses, the bottom one grass down, the top one grass upwards.

MODE OF MAINTENANCE.

We have now made our road, and will consider how it is to be maintained, and this question is marked by wide difference of opinion.

The system that is now generally adopted, is to divide the road into sections of from 3 to 8 miles, and to place each section in charge of a skilled labourer, with one surveyor in charge of a district with 80 to 160 miles of main road. The district council roads are mostly managed in the same way.

If all roads were constructed in the manner described in this paper, the duties of the surveyor would be light, but many of them are simply worn tracks that have been covered with macadam to an average thickness of about 5½ inches, often on a clay sub-soil that works through and changes with the weather.

The writer's practice is to have the road scraped or swept clean before applying the fresh metal, the new material to be the hardest attainable, and to be broken by hand (*on the roadside where possible*), to a 2½ inch ring. Occasionally a 2 inch stone is used. The new metal to be kept as clean as possible, and spread one stone thick, one ton to cover 12 superficial yards; this to be *dry* steam-rolled without any blindage till the stones are fixed, and then the smallest possible quantity of blindage. The road scrapings are stored for this purpose in heaps till vegetation has decayed.

Surveyors differ in opinion, some use 10 per cent. of the screenings from the machine as blindage; the writer has tried these, but prefers the road scrapings.

A slurry must be made to fix the top stones, and even with a sticky slurry the hammering of the horses' hoofs causes some stones to work loose, and the roller should be kept in the neighbourhood to dry roll this after a few days.

With a properly constructed road, longitudinal machine scarifying before laying the stone is economical of material, but hand scarifying by picks across the road is very destructive to the road, and wasteful. The writer maintains over 1,000 miles of road and does not scarify any; if the road is hard it is well watered before the stone is spread. 15-ton rollers and two-wheeled water-carts are used, and a pump, independent of the water-cart, capable of filling the water-cart in 10 minutes. Water should not be stinted, though sometimes the distance to be hauled may be six miles.

The rollers consolidate about 30 tons of basalt or granite, or 40 tons of limestone, per day. The difference in pressure of roller surface between a 10-ton and a 15-ton steam roller is only about 35 lbs. per square inch.

The drainage of the road should be attended to, grips, ditches, and water tables cleaned, and the sides of water tables cut yearly.

The use of mechanical traction, motor cars with rubber tyres, and the army of bicyclists, have increased the cares of those having charge of the main roads; more attention must be devoted to the surface of the road, 1 inch to 1¼ chippings must be kept on the roadside to patch holes or depressions. These holes are mostly the result of incompetent men spreading, a good spreader of road stone is invaluable.

Motor cars have part of their machinery slung below the body of the car, the pneumatic tyres suck the small grit from the road surface, and the parts below the car blow it up in the air.

The prevention of dust is a difficult problem. At several periods in the history of roads, tar has been used to assist in binding the road material, and from various causes has been abandoned. That in urban districts it will save the heavy cost of watering, is proved. In rural districts where there is no watering, (the writer maintains 1,000 miles of road and does not water one mile,) the cost to a county council is prohibitory; to tar the main roads of Gloucestershire would cost £50,000 per annum, about £50 per mile. The dust is not all caused by the material of the roads.

The solution appears to be the use of the hardest and heaviest stone procurable, to use as little blindage as possible, and perhaps to grout it with pitch and tar before applying any blindage, after it has been dry rolled. Limestone and all the softer stones that make mud in winter and dust in summer will cease to be used.

[*For Discussion on this Paper, see page 669.*]

MACADAMISED ROADS AND DUST.

By A. P. I. COTTERELL, M.Inst.C.E., F.S.I.

PROBABLY nine-tenths of the roads in England and Wales are macadamised: in fact, we may take it that practically all the roads outside the townships come under this description.

In the days of Telford and Macadam the question of dust was probably of little account. When they came upon the scene they found the main roads of England in such an execrable condition that their efforts were directed toward making a road surface and gradients fit for the traffic of those days. Macadam's plan was to obtain a kind of mosaic of small stones which should cling into one another, thus presenting a uniformly hard surface. He does not appear to have concerned himself about the character of the foundation in the same way as did Telford, who made a great point of this portion of road construction. Both, however, laid great stress upon drainage of the subsoil and upon keeping the road materials as dry as possible, so as to diminish the solvent action of water.

There are several essentials for a good macadamised road that cannot now be touched upon, such, for instance, as a foundation sufficiently substantial to support the traffic, without which the very best surface must inevitably go to pieces.

One of the requirements of a macadamised road on which horse traffic is used is that it shall be slightly elastic. Theoretically, an unyielding surface may be better for vehicles; but practically a considerable amount of wear will ensue both to the road and to the vehicle, unless the road surface is slightly responsive to any jar. For the horse, a slightly yielding surface is imperative. Even with the macadamised roads made as they are we shall remember the old saw, "It ain't the hunting that hurts the horse's hoofs, but it's the hammer, hammer, hammer on the hard high road."

This vital requirement of elasticity is really one of the chief causes of the trouble experienced with dust.

It has been pointed out that a cubic yard of metalling, 2 in. to 2¼ in. cube, when screened and laid down in regular layers 6 in. thick, contains no less than 40 per cent. of interspaces. These interspaces have to be

filled with smaller material, some of it gravel or sand, but most of it fine dust or mud, according to the state of the weather and the character of the road-stone. The function of this soft intervening material is to form a cushion to preserve the stone from the heavy blows of the traffic and to absorb the shock that would otherwise be unpleasantly felt by the horse or the vehicle. The character of the intervening cushion thus becomes important, for if when the road surface dries it is converted into a fine mobile dust, that is easily dispersed, a stone gets kicked out, and an opening is made, which if not quickly attended to will soon result in the disintegration of the road. The way in which some of the material used for metalling is affected by water aids this process. It therefore becomes obvious that the best road surface will be that where the material filling the interspaces has a high specific gravity, is not easily pulverised by shocks, and is not reduced to fine dust or mud by the action of the weather.

Another common defect arising from the same source is that a macadamised road surface rarely retains the even convex shape in which it was left by the steam roller for long. The soft material between the stones will be greater in one part than in another; consequently as it gives way or comes out, especially if a stone or two is loosened from the road surface, the road wears away and a hollow is formed.

It has been said, and is very generally believed, that motor cars are the cause of dust. But motor cars would not raise the dust if the dust were not already there, either on the surface or in the interstices of the metalling. Everyone will agree that the dust raised by cars is a great nuisance, making other road users as well as residents by the road side miserable; but it is better to get at the cause of the trouble than to blame the instrument, and the cause is undoubtedly the fine material that lies upon and between the metalling.

It has been pointed out by Mr. O'Gorman that the hollows and the irregularities of the surface are largely the cause of dust raised by motor cars. It constantly happens that while one driving wheel is making good and effective contact with the road, the other wheel is skipping lightly into a hollow in which dust may be lying. When a vehicle is moving slowly the wheel has time to traverse the full contour of the hollow, but when travelling rapidly it bounds from the ridge into the midst of the hollow, spinning round meanwhile, and so acts like a brush directly it comes in contact with the dust. The effect of this action is very easily realised.

On every macadamised road there must always be some breaking

down of the surface from the pounding of the horse's hoof and the grind of the tyre. The only way to deal with this is to get rid of it as quickly as possible, for it does no particular good to the road to leave it there, and it certainly does no good to the road user or to residents by the roadside. Slow moving traffic may not disturb it, but directly a motor car or bicycle comes along the light debris is sent flying; whilst, if there is nothing else, the wind will see that it gets thoroughly distributed.

The more that sandstone and silicious material are used, the less will be the dust produced. Sand, moreover, cannot so easily blow about in clouds, neither can it be churned into a fine impalpable dust, like limestone.

There appear to be three directions along which efforts may be made to reduce dust:—

(*a*) By treating the macadamised surface in such a manner as to retard the formation of dust, or to fix it when it is formed.

(*b*) By introducing another substance as a cushion between the metalling, in place of the grit and dust with which the interstices are usually filled.

(*c*) To use as road material stone of a silicious or basaltic nature, less liable to be broken down by wear or dissolved by moisture.

(*a*) The City Engineer of Bristol has very kindly furnished the results of experiments as to the relative cost of dressing the roads with different dust-preventing solutions. The experiments took place in Coronation Road, Bedminster.

The first preparation was spread on the 24th June, 1905. Subsequent applications were made on the 26th and 27th June, and 4th, 5th, and 7th July, six applications in all. At the end of a week there were complaints of the dust rising, but after the fourth, fifth, and sixth applications the road stood fairly well until the 17th July, when the whole road had to be watered, and it was found necessary to resume the ordinary street watering on July 29th. The cost of this application worked out to 6s. 9½d. (or ·0136 of a penny per square yard) per day, as compared with 4s. 4d. (or ·0086 of a penny per square yard) per day had ordinary watering been adopted.

The second preparation was applied from the 8th July to the 17th, altogether five applications. The dressing stood till the 17th August, no water being required during this interval except in channels, which were flushed out once a day from the 28th July. The cost worked out to 4s. 7d. (or ·0091 of a penny per square yard) per day, as compared

with 4s. 10d. (or ·0096 of a penny per square yard) per day had the road been treated with ordinary water. Those who had formerly complained as to the street watering, both spoke and wrote of the good results of the experiment.

No record was kept of the reduced cost of cleansing, but it is probable that there would be a saving as compared with ordinary street watering.

In Liverpool records were kept in 1902 and 1903 of the cost of treating certain macadam roads with oil. The cost appears to have varied between ¼d. and ½d. per square yard, according to the amount of oil used, and Mr. Rathbone, from whose paper these particulars are gathered, states that the total reduction in the cost of cleansing and watering was from 13d. to 5·5d. per square yard for a period of twenty-one days. Apparently the treatment resulted in a distinct saving in maintenance as well as reduction of wear, but, on the other hand, the oil did not form a very pleasant surface for traffic and the smell was complained of. In 1903 the oil was applied more carefully and renewed at intervals of three weeks, and the cost was stated to be ·0022 of a penny per square yard per day, as compared with ·0033 of a penny per square yard per day, the cost of ordinary street watering.

The difference in results obtained in Bristol and Liverpool is probably due to factors which have not been noted, such as the kind and quantity of traffic. No two roads are exactly comparable.

It is probable that the trouble from dust can be very much palliated on existing roads by the use of calcium chloride and other similar solutions without appreciably increasing the cost of watering, if at all. On the other hand, the best way to make dustless roads is to use better material. A bad material can never be made permanently satisfactory by simply fixing the surface dust.

(*b*) Treating the roads with a watering solution may be possible in urban, but, as a rule, it is altogether beyond the means of rural districts, and another method must be found. The dust nuisance has been successfully tackled by coating newly rolled metalling with boiling tar and pitch. Immediately after the road is formed the tar and pitch is applied in a flat stream from a watering pot. It is then dressed with fine flint grit and allowed to stand a day or two for consolidation before the traffic passes over it. Even with Mendip limestone, which is notorious for giving off dust, this method has been found to be successful.

Another example of the second way of overcoming the dust nuisance is the use of tarred macadam. This has been tried for some years with more or less successful results. Tarred slag appears to have answered well in

some of the busy thoroughfares of London. The tar, as in the previous case, is applied hot, the slag being also heated to dryness. Apparently better results have been obtained with slag than with limestone or basalt.

This method will probably be followed up still further, and there can be no reason why it may not become uniformly successful. It appears to aim in the right direction of substituting for dust an elastic and non-friable material as a cushion between the stones.

(*c*) Anyone who travels over the country will notice how much less dust there is where basaltic or silicious stone is used than where limestone is used. If every macadamised road could be made up with basalt the dust question would assume a very different aspect. It is not only that such roads are less easily broken down by weather, but the material being of greater specific gravity is not so easily moved by wind. The argument against the more general use of basalt, in districts remote from basaltic quarries, is its cost. But it does not necessarily follow that a material which is cheapest in first cost will be cheapest when the cost of maintenance is taken into account.

In Bristol we have about 234 miles of macadamised roads of which 32 miles are repaired with basalt, and the remainder with local mountain limestone. We have been considering the advisability of repairing an additional 32 miles with basalt, and the City Engineer has submitted the following estimate to the Council:—

Comparative Statement of Annual Cost on present area of Macadamised Highways.

Year.	Present System.	Alternative.
	1st Class Granite 2nd Class Limestone 3rd Class Limestone 2nd and 3rd Abbots Leigh Quarry.	1st Class Granite 2nd Class Granite 3rd Class Limestone Limestone to be obtained from other sources than Abbots Leigh.
1st	£28,000	£32,600
2nd	do.	32,600
3rd	do.	32,600
4th	do.	32,600
5th	do.	23,400
6th	do.	23,400
7th	do.	23,400
8th	do.	28,000
9th	do.	28,000
10th	do.	28,000
11th	do.	28,000
12th	do.	28,000
13th	do.	28,000
Average cost per Annum.	£28,000	13 / 368,600 £28,354

It will be seen that the effect of the increased use of granite will be to increase the expenditure for 4 years, and afterwards to decrease it so that on an average of 13 years the actual additional outlay will be only £354 per annum. Against this must be set the saving in cleansing and watering, which is always less with granite than with limestone, so that the probabilities are that the granite road will cost less to the ratepayers than the limestone one, although the limestone quarry that would be given up is worked by the city itself and lies close to the river in one of the finest positions for supplying stone economically.

This may be an answer to the natural argument, that expenditure in dust prevention may be all very well for towns, but quite out of the question in the country; for in many parts it is possible, by means of a bold capital expenditure, to provide a better and less dusty road, at practically no greater cost to the ratepayers, especially if a short period loan can be obtained.

The City Engineer has also kindly furnished results of some tests made by him into the wearing properties of different classes of stone. The first test was in Clarence Road, New Cut, where ten different kinds of stone were tried. Three basaltic areas outlasted the period of the test. The basaltic stones also gave off less debris as measured by the loads of slop removed.

Description of stone.	Date when laid.	Quantity of slop per week in loads per 100 yds. super.	Date of repairs.
1. Basalt from the Midlands ...	19 Sept., 1900	·105	none
2. Quartzite, Glos.	24 Oct., 1900	·157	30/10/01 31/1/02 19/8/02
3. Basalt	14 Nov., 1900	·132	14/8/02
4. Basalt from the Channel Islands.	1 Feb., 1901	·108	14/8/02
5. Leicester Granite	19 Dec., 1900	·112	none
6. Basalt from Cornwall	12 Dec., 1900	·130	19/8/02
7. Mendip Limestone	5 Dec., 1900	·148	30/10/01 31/1/02 14/8/02
8. Warwick Granite	17 Nov., 1900	·174	14/8/02
9. Local Black Rock Limestone ...	12 Sept., 1900	·225	30/10/01 31/1/02 16/8/02
10. Basalt from Cornwall	5 Sept., 1900	·145	none

In January, 1905, the whole road was taken up and relaid with pitching.

A further test is now being carried out in Silverthorne Lane, St. Philips, as given by the following table:—

Description of stone.	Date when laid.	Quantity of slop removed per week in lbs. per yd. super.	Remarks.
Cornish Basalt ... ... (spec. grav. 3·02)	10 Oct., 1905	5·17	
Local Limestone ... ... (spec. grav. 2·67)	10 Oct., 1905	7·86	
Gloucestershire Limestone (spec. grav. 2·66)	11 Oct., 1905	7·16	
Gloucestershire Quartzite (spec. grav. 2·56)	14 Oct., 1905	6·64	
Gloucestershire Quartzite (spec. grav. 2·62)	18 Oct., 1905	7·38	
Welsh Basalt ... ... (spec. grav. 2·82)	23 Oct., 1905	9·23	This section is in a narrow part of the road close to a bridge where the wear is excessive, and therefore not comparable with that on the other samples.
Cornish Basalt	26 Oct., 1905	6·27	
Welsh Basalt	30 Oct., 1905	4·51	
Devonshire Trap	4 Nov., 1905	8·08	

The quantity of slop was weighed after drying under cover till it became hard. That removed from the Welsh and Cornish basalts is less than that from limestone, with the exception of one sample of basalt where the conditions of traffic put it under an unfair test.

The conditions under which these tests were made render them necessarily somewhat approximate, so that no detailed deductions can very well be made, but they certainly show that with a harder road material less slop, and consequently less dust, may be expected.

In one of the popular books written by Mr. H. G. Wells, he introduces as a road material of the future a substance called "Eadhamite." He tells how this material forms such a magnificent roadway that railways are completely outclassed and become obsolete, their place being taken by wide Eadhamite roads, along which motor vehicles rush up and down the land. Possibly this is the material we are all trying to obtain. If it will give off less dust and be more durable than our present macadamised roads, then we shall welcome Mr. Wells' recipe, and be ready to accord him a place amongst road reformers equal to that of Macadam or Telford.

[*This Discussion also applies to the Paper by* MR. ROBERT PHILLIPS, *page 658.*]

DR. RIDEAL (London) pointed out that minute chemical differences affected the hardness of road materials, and that the specific gravity seemed to have little

bearing on the problem. Mr. Cotterell showed that the lightest basalts and quartzites gave the smallest amount of detritus. As to remedies, cutting down hedges in rural districts and treatment with salt solutions (preferably electrolysed, so as to insure a sterilizing action as well) seemed to be best in towns.

Mr. Thos. Reader Smith (Kettering) said, with reference to the use of dust-laying compositions, a section of a main road, 300 yards in length, was used for experiment last year in Kettering, with satisfactory results. Dust was not absolutely prevented but was much reduced, and shop keepers were much pleased with the improvement. The solution was applied 11 times and the section would otherwise have been watered 195 times, which would have cost very nearly as much as the special treatment. As to the improvement that would follow the use of better material for ordinary macadam roads, the results of a number of experiments he had made in grinding granite and slag, showed that the granite was 50 per cent. more durable than the slag, and he assumed that if the grinding had been done in the wet, as frequently happens under traffic in the streets, and the various conditions of weather allowed for, the granite would last at least twice as long as the slag. His Council made the change in the material for their main roads, with a marked improvement in the reduction of mud and dust and consequently in the cost of scavenging; also the roads were improved and repairs less frequent, so that the use of granite costing twice as much as slag was fully justified.

CONGRESS AT BRISTOL.

CONFERENCE OF VETERINARY INSPECTORS.

ADDRESS

By FRANK LEIGH, F.R.C.V.S.

President of the Conference.

PROBABLY my being a resident here, an old Bristol boy born and bred, together with my associations in municipal matters, are the sole reasons for my occupying the position of President of the Conference.

When I was asked by The Royal Sanitary Institute to accept this important office, I felt I was not competent to fulfil the duties with credit to our profession; but when our recording secretary promised his assistance I became inspired with confidence, knowing that whatever he promised he would most certainly carry out. I feel that I have at least one characteristic which will help to fit me for the post, that is a firm desire to do my best, and a devout faith in the assistance you will all give me. Fortunately success does not depend on the President, it rests upon the papers to be read and the contributions given in debate by you all.

The city of Bristol, which I am very proud to claim as my birth-place, is no mean city, having a population of 360,000. It abounds in interest suited to all tastes; even the most fastidious cannot fail to find something to interest or amuse them. It is famous for its beautiful and numerous churches and for its ancient buildings and architecture; for its charitable institutions it stands pre-eminent; and for its suburban beauty and picturesque scenery no other English town excels it.

The citizens of Bristol extend to you all a hearty welcome; they have done their best to provide every facility for enjoyment, scientifically and

socially, and I hope that you will take advantage of those facilities. Those of you who have been prevented from coming earlier to the Congress, and thus taking part in the various social functions and entertainments provided by the Lord Mayor and other prominent citizens during the week, will have the opportunity of attending those excursions and entertainments allotted for the last two days. If I personally can do anything in any way to add to the enjoyment of your visit to Bristol, I trust that you will come to me for any assistance or information. One of the greatest pleasures I shall get out of this Conference will, I hope, be the gratification of a feeling that I was able to do something for my brothers on their visit. Bristol, I regret to say, has not taken up the position she should have done in the veterinary scientific world, this being the first time in my experience of twenty-two years as a practitioner that we have had a meeting of veterinary surgeons in Bristol, either in connection with a sanitary congress or a veterinary society. I hope that this Congress may be a fruitful source of development, and that veterinary surgeons, neighbours practising in and around Bristol, may join with me, and let us come out of that hybernating state in which we have so long existed. Let us come forward and identify ourselves in scientific matters associated with our city and the west of England, and let us prove ourselves to be worthy members of a worthy profession.

I must say that no two subjects could possibly be of greater interest to veterinary surgeons than the two entrusted to Mr. Lloyd and Mr. Dunstan, they interest, also, a far wider class.

We are all consumers of milk, and its contamination is a real and serious matter to the whole population. I consider that the special food of infants and invalids should be free from danger, and that the strictest precautions should be adopted to render it largely available and of absolute purity. But there is another side of the question, and that is that the producer should not be unfairly harassed by unnecessary regulations, or by mistaken suspicions. The cowkeeper and dairyman carry on business which is to some extent suspect. Whenever an outbreak of disease occurs, milk is one of the first articles suspected, and where human life is concerned the earliest interference with a possible cause is justifiable. But more than one instance has occurred where grave injustice has been inflicted upon the producer or purveyor of milk. Regulations for the protection of man should be so carried out as to give the least possible injury to the milk producer and to the meat purveyor.

The medical officer of health and the sanitary inspector are not the

men best acquainted with cattle in health and in disease. The public are best protected, without injury to the farmer, butcher, and dairyman, by the combined wisdom of those officers and the assistance of a trained veterinarian. Many years ago the supposed discovery at Hendon of some direct connection between an outbreak of scarlet fever in man and an unrecognised disease of cows led to gross injustice to a cowkeeper. This would have been prevented by recognition of the services of a veterinarian. It is not fair to assume that there are serious diseases of animals transmissible to man which have escaped the notice of veterinary observers; such assumption should at any rate be followed by the invitation of veterinary co-operation in investigating the outbreak.

The second paper we have to consider relates to anthrax, a disease which only attacks man as the result of contagion derived from a previous disease in animals. Whether man is affected directly from handling a diseased animal in this country or from the hide, hair or wool infected in a foreign country, it is always primarily a disease of animals. Prevention then must always be directed to the control of the disease in animals. So far as the home animal goes, our regulations seem sufficient if properly carried out. As to the foreign animal which sends in infective material, I cannot but think some greater care might be taken at our ports. If it be true that wool, hair and hides from certain foreign parts are always infected they should be stopped from importation. I recognise that no harassing restrictions on trade should be imposed, but where human life is concerned the import of deadly dangerous material should be prohibited.

The mere existence of a law prohibiting such dangerous imports as dropped fleeces, which means often the fleece removed from an animal dead of anthrax, would soon force the vendors of such material to be more careful, and to cease sending it.

Every importation of anthrax infected material is a danger not only to the workers employed upon it but to the home stock of the country. The spores of the anthrax bacillus are not easily killed, and the waste from works goes as manure to our own fields and pastures to spread disease among our own stock.

The veterinary section of a congress on sanitation is comparatively a small part, but it is an indispensable one. So long as there are diseases of animals transmissible to man, so long as animals supply food for man, and so long as animal products (hair, wool, and hides) are necessary to the wants of civilisation, so long must the veterinarian play an important part in advising and protecting the community.

Before the appearance of cattle-plague in 1865, nothing was done in the way of public veterinary hygiene. Veterinary practitioners gave assistance merely as private advisers, and although their help was valuable it was limited to the individual, or to a small district. The cattle-plague caused such fearful losses in England that attention was directed to the class of men who stayed its ravages and finally stamped it out.

The Government recognised the value of veterinary assistance not only in the treatment of diseases of animals, but in the far more important and economical matter of prevention. Legislation followed, and was under the direction of veterinarians. Success was attained, and pleuro-pneumonia and foot-and-mouth disease were eradicated from the country. When the first Contagious Diseases of Animals Act was passed in 1869 very little attention was paid to the diseases transmissible to man, but gradually enlightenment spread, and rabies and anthrax were added to the scheduled diseases. The first of these was attacked solely because of its danger to man; the regulations were gradually improved and made more rigid, with the result that within a space of about four years rabies in dogs was stamped out and hydrophobia in man disappeared from the kingdom.

Glanders is another disease that has been for a long time scheduled under our Diseases of Animals Act, but the regulations for its suppression are antiquated and inefficient. No one knows how many human lives are destroyed by this disease of horses, but it is gradually being recognised that they far exceed the number found in the returns of the Registrar-General. The loss of human life would cease entirely from this cause on the suppression of the disease in the horse, and it really seems inexcusable that our Government ignores the serious danger to human life and permits an annual loss of about 2,000 horses.

Tuberculosis exists in animals and man, and whilst a commission is still at work on the subject I refrain from any long argument as to the danger of the disease. It is not provided for by legislation. Under the Dairies, Cowsheds, and Milkshops Order a cow with a tuberculous udder may be ordered to be removed; but it may pass into another cowshed, it may be used for breeding purposes, or it may be converted into meat for man.

The loss to the agriculturist from this contagious disease is ignored by Government, and the danger to the public from infected milk is met only by the almost useless provisions of the Dairies and Cowsheds Order. The whole danger to man might be prevented by the scheduling of the disease

under the Diseases of Animals Act, and the loss to farmers would every year be appreciably diminished.

During the last ten years there has certainly been a great awakening to the importance of veterinary hygiene. The Board of Agriculture has made greater use of the services of trained veterinary surgeons. Local authorities have utilized our services as meat inspectors, and consult us regularly as to the outbreaks of disease likely to devastate stock or infect man. Still, there is much more room for progress, and I welcome these congresses as means to bring about a further appreciation of veterinary science as an important factor in the practice of sanitation and in the work of public health.

I have no desire to magnify the importance of this Section of the Congress. In a few years I earnestly believe it will take its place as an essential part of any organised conference on hygienic matters; and I should not to-day have insisted upon its importance had I not felt that it is capable of rendering more valuable services than are generally recognised.

MILK CONTAMINATION IN COLLECTION AND TRANSIT.

By J. S. LLOYD, F.R.C.V.S.(London), D.V.S.M.Vict.(Manchester),

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ABSTRACT.

IN dealing with the question of milk contamination, it is perhaps best in the first instance to define "clean milk." The only practical answer to, What is clean milk? is to state that it is milk drawn from the healthy udders of healthy cows under the greatest practical precautions against contamination that can be taken both during milking and whilst in transit to the consumers.

Strictly speaking the addition of anything to milk, whether by accident or design, at any time between its production by the cow to its consumption by the consumer, is to contaminate it.

Proof of Contamination.

The changes taking place in contaminated milk can be studied in several ways, physically, chemically, bacteriologically.

The physical examination may be by means of the naked eye, noting alterations in colour or consistency; by taste, noting alterations such as acidity or bitterness: or by smell, noting the presence of unnatural odours absorbed by the milk such as for example from fish, turpentine, paraffin, camphor, garlick, etc., or which may be caused by bacterial changes in the milk itself. Other physical proofs of contaminated milk are, however, often met with. One of the most common is sedimentation, or the falling of solid particles of dirt to the bottom of the vessel in which milk is contained. This can be seen in almost any basin of milk produced under ordinary farm conditions.

Another common proof of dirt contamination is seen in the slime from

a "separator" after use. Here owing to centrifugal force the dirt being heaviest is thrown to the side of the tube or bowl of the separator, whence it may be scraped off as a thick dirty, sometimes nearly black, slime.

In milk which has been produced under exceptionally dirty and dusty conditions, and particularly if then only imperfectly sieved, large quantities of filth, dust, hair, straw, etc., may be seen floating on the surface. In a case of this kind some year or so ago a farmer was fined £25 and costs, under Section 47, Public Health (London) Act 1891, for selling milk unfit for the food of man.

The chemical examination of milk is more often used to test quality than contamination. A simple test which can be used for contamination, however, is that of reaction. Normal milk is generally more alkaline than acid, but often not distinctly one or the other. If distinctly alkaline it is probably due to the addition of some alkali such as carbonate of soda. When distinctly acid it may be due to the milk becoming sour by lactic fermentation, and then it is an indication that the milk is not fresh.

Milk can also be examined bacteriologically for contamination, in fact, this is the most scientific and at the same time the most accurate method. Microscopic examination of the milk and of the sediment, obtained by centrifugalisation, may reveal the presence of colostrum, blood or pus cells, algæ, fibres, moulds, yeasts, hair, etc. Films can also be examined to discover the presence of specific bacteria such as the bacillus of tuberculosis, streptococci, actinomyces and such acid-fast micro-organisms as the timothy grass or mistal bacilli.

The most delicate and also most accurate bacteriological test for suspected milk is its inoculation into test animals such as the guinea pig. This test will in many cases reveal the presence of tubercular infection when an extended microscopic examination fails to discover the tubercle bacilli.

Numerous series of examinations of contaminated milk have been made all over the world, of which the following may be taken as examples:—

Dr. Collingridge, Medical Officer of Health, City of London, in his annual report for 1904, states that out of 39 samples examined, over 50 per cent. were not clean or pure. Professor Delepine ("Food Poisoning and Epidemic Diarrhœa") states that 10 per cent. of non-refrigerated milk when inoculated into guinea pigs caused death in less than 10 days, whilst with refrigerated milk the percentage of deaths was as follows:—1898, 2·7 per cent.; 1899, 1·14 per cent.: 1900, 3·6 per cent.; 1901, 1·24 per cent.

Dr. A. C. Houston ("The Bacteriological Examination of Milk")

conducted a series of investigations of milk procured under different conditions, and found that generally the samples taken from the shops of purveyors and dairymen were the worst contaminated, those taken direct from railway churns being next in the scale.

Sources of Contamination.

Further proof of contamination can be found by enumerating shortly the sources at the farm or cowshed, in transit, at the milkshop, and in delivery. If the sanitary conditions of the cowshed alone are taken into consideration, in many cases it will be seen how impossible it is to produce milk free from contamination. As the sources of contamination are well known it will be unnecessary to do more than merely mention them.

Contamination at the Farm.

The sources here are insanitary cowsheds, dirty or diseased cows, especially cows with diseased udders, unclean and diseased milkers, dirty milk vessels, exposure of milk to dirt, dust, dogs, cats, and flies, proximity of sewers, middens, piggeries, poultry and pigeon houses, dirty and badly ventilated dairies, impure water supply, want of proper sieving, mixing of old and fresh milk.

Contamination in Transit.

The common sources are dirty and badly made milk churns, carriage in ill-ventilated milk vans, particularly if carried in conjunction with fish and other strong-smelling articles.

Contamination at Milkshops.

Milkshops are frequent and fertile sources of contamination. The shops are often unsuitable for the purpose, being in many instances general stores selling anything from a red-herring to a box of matches. Upon the counter of such shops there are often uncovered pails of milk, catching dust, absorbing bad smells, and being used by flies as places for bathing or committing suicide.

Contamination during Delivery.

Delivery in open milk pails, pails with badly-fitted covers, exposure through having the lid lifted off every time a customer is served, diseased or dirty milk-sellers, wet weather causing drippings from the sleeves of the milk-sellers into the milk-can, exposure of milk-measures by being carried openly in the street, deposited in a dirty cart or in the pocket of the milkseller.

Conditions favourable to Bacterial growth in Contaminated Milk.

Granted exposure of milk to the atmosphere, if only for a few seconds, contamination by dust etc. results, and accompanying that dust is certain to be a larger or smaller number of bacteria. Milk from clean cows, procured under cleanly conditions, seldom has less than 2,000 bacteria per c.c., whilst from dirty cows the number may easily be 100,000. Bacteria, however, are known to come from the udder of the cow, certainly when diseased, and often when healthy. Henderson (*Veterinary Record*, vol. 18, No. 918), after stating that Swithinbank and Newman (Bacteriology of Milk) recognise that "the first milk drawn from the udders of milking-cows always contains the air bacteria which have gained access to the milk during the interval since the last milking," gives particulars of bacteriological examinations upon a number of normal udders with the result that several of them exhibited staphylococci, three exhibited pseudo-diphtheritic bacilli, and two exhibited streptococci, in addition to other organisms, but from four of the udders the germs were inoculated into guinea-pigs with a negative result, thus proving that the micro-organisms in those particular instances at any rate were non-pathogenic. Upon the other hand it is well-known that given diseased conditions of the udder such as catarrh or tubercular mastitis large numbers of pathogenic organisms are always present.

Milk as drawn from the udder is at a temperature of nearly 100° F., an ideal temperature for bacterial growth. If the milk is not promptly cooled to a temperature below 55° F. a rapid multiplication of bacteria follows, with the result that the number of organisms present at the end of twenty-four to forty-eight hours, instead of being thousands per c.c. becomes millions.

This multiplication of germs in milk goes on very rapidly, and keeping milk at a temperature exceeding 50° F. is a condition very favourable to bacterial growth.

Effects of Contamination.

By the consumption of contaminated milk disease may be conveyed to the consumer, and such disease may be either milk-produced or milk-borne. A disease common in milking cows is tuberculosis, and numerous experiments have proved that so far as domesticated animals are concerned the milk from cows suffering from tubercular mastitis will cause tuberculosis when consumed by them. Whether such milk will cause tuberculosis in persons consuming it is at present a question being investi-

gated by a Royal Commission, whose Report is not yet to hand. So far the majority of medical authorities appear to agree that tuberculosis of the intestines in human beings, and especially in young children, may sometimes be of bovine origin, caused by the consumption of milk from cows suffering from tuberculosis of the udder. Epidemic diarrhœa is another disease in human beings which there is strong reason to believe is often caused by the consumption of contaminated milk.

In his paper "Food Poisoning and Epidemic Diarrhœa," Professor Delepine sums up the matter as follows:—

1. "Epidemic diarrhœa of the common type occurring in this country is apparently in the great majority of instances the result of infection of food by bacilli belonging to the colon group, or bacilli which are present at times in fœcal matter."

2. "Milk, which is the most common cause of epidemic diarrhœa in infants, is frequently infected at the farm or (through vessels) in transit."

Epidemic sore throat in human beings is another disease supposed to be caused by consumption of the milk of cows suffering from suppurative mammitis. Such an outbreak occurred at Woking in November, 1903 (see *British Medical Journal*, December 5th, 1903).

Other diseases which have been stated to have been produced in human beings by consuming contaminated milk are pseudo-diphtheria, septic fever, foot and mouth disease, cowpox, anthrax, etc.

Epidemics of milk-borne diseases have been fairly common, but almost invariably the source of infection has been a human being, and in such cases the milk has simply been the conveyance by which the infection has been carried to other persons. The three diseases most commonly considered as milk-borne epidemics are scarlet fever, diphtheria and typhoid fever. In regard to the last, there is strong reason to believe that the infection has in some cases arisen through farm water supplies being contaminated with sewage, whilst in others no doubt personal contamination of milk has been the source of the mischief.

Methods of Preventing Contamination in Milk.

The aim of all sanitary authorities, whether state or municipal, must be to see that milk is produced from clean and healthy cows, housed in clean and sanitary cowsheds, provided with good food and pure water, attended and milked by clean and healthy attendants; that the milk is removed as quickly as possible from the cowshed or milkshed to a clean, cool and sanitary dairy for the purpose of being immediately sieved or

filtered, refrigerated, and placed in churns or bottles, and so kept from exposure to the air and consequent contamination.

During transit milk should only be put into properly constructed and clean churns; these during conveyance to and from the railway stations should be locked or sealed, protected from the rain, and not allowed to stand in the sun and exposed to dust on hot and windy railway station platforms, but immediately placed for conveyance in clean, well ventilated, cool or refrigerated milk vans, used for no other purpose.

Delivery to customers' houses should, if possible, be by airtight, clean pint or quart bottles. If larger bottles or churns are used these should be provided with taps which in turn should be covered when not in actual use. Open milk cans and dipper measures should not be used unless special precautions are taken to prevent exposure of both them and the milk to dust or rain. In the dairy or milkshop milk should only be kept in small quantities for immediate sale, and then only in properly covered, clean utensils, larger quantities of milk being stored in a clean, cool, and well ventilated room, or in a refrigerating chamber.

The cowshed should be kept as clean as possible and so lighted that all parts are easily visible when the doors are closed, otherwise, dirt will not be seen. It should be ventilated by means of inlets and outlets so that the air will not be oppressively hot or stuffy. The windows ought to be opened in hot weather. The cubic contents should not be less than 600 cubic feet per cow for small cows, up to 800 cubic feet for large cows.

The cowshed is best built open to the roof and ought not to be less than 18 feet wide, having a feeding passage in front of the cows and a milking passage behind them, each not less than three feet wide. The floor should be made of some impervious material, preferably flag-stones, well set in cement or concrete. The partition in front of the cows must be high enough to prevent the cows getting their heads over into the feeding passage. The stalls should not be longer than 7 ft. 3 in. to 7 ft. 6 in. including the feeding trough, and if double stalls, they should be about 7 ft. wide. Single stalls 3 ft. 9 in. to 4 ft. are preferable if only to prevent cows treading upon their neighbour's teats. The feeding trough is best made of glazed earthenware and set upon the level of the floor. There should be a drop of 4 in. to 6 in. from the stall to the dung channel, the latter being 2 ft. wide with a slight fall backwards to the urine channel, which should be 1 in. lower and about a foot wide. The fall lengthways in the urine channel should be about 1 in 80, and should empty on to a trapped inlet to a drain outside the cowshed.

The manure should be removed from the cowshed at least four times a day, and the channels flushed with water once daily. For the latter purpose, and also for convenience in watering the cows it is advisable that a piped supply of water be provided in each cowshed. The cows should be provided daily with good, clean bedding, they should be kept clean by regular grooming or brushing, and their udders and teats washed and dried before milking if necessary.

The cowshed should not be used for storing food, and it should not be filled with dust by brushing the cows or the building or by foddering, just immediately prior to or during milking. It is preferable to milk either in a clean, special milking shed, or in the open air. There is less liability to contamination by the use of milking machines or hygienic milking pails.

The milkers should be healthy persons, certainly not tuberculous or suffering from any infectious disease; they should wear clean overalls, and have clean hands and short nails. Wash-bowls, water, soap, and towels should be provided in or near the cowshed for cleansing the milkers' hands. Dry milking should be enforced, and at each milking the cows' udders should be examined for diseased or abnormal conditions. The milk of cows with diseased udders should not be used for human consumption, and cows exhibiting signs of tuberculosis of the udder should be notified to the local authority where the milk is consumed. Immediately each cow is milked, the milk should be taken direct from the cowshed to a clean and sanitary dairy to be at once sieved and cooled. It should not be left in open vessels, exposed in the cowshed, or placed so as to be accessible to dogs, cats, or flies. After cooling, the milk should be at once put into clean, covered milk utensils, preferably air-tight stoppered bottles. In cooling the milk it is essential that the temperature be lowered to at least 50° F., and in the summer it will often be necessary to use ice in order to obtain such a low temperature.

Dairy Inspection.

For nearly thirty years State and municipal sanitary authorities have been trying to solve this question of milk contamination, and only, it is to be feared, with limited success. Not but that these authorities know what ought to be done to protect milk from contamination; the question rather is how to get it done.

Since 1879 dairies, cowsheds, and milkshops orders have been in force, and under the order of 1885 local authorities *may* make regulations for any or all of the following purposes:—

For the inspection of cattle in dairies.

For prescribing and regulating the lighting, ventilation, cleansing, drainage and water supply of dairies and cowsheds in the occupation of persons following the trade of cowkeepers or dairymen.

For securing the cleanliness of milk-stores, milk-shops, and of milk-vessels used for containing milk for sale by such persons.

For prescribing precautions to be taken by purveyors of milk and persons selling milk by retail, against infection or contamination.

It should be noticed above that local authorities *may* make regulations (it is not *shall* or *must*), and no doubt that one word accounts for much that has been left undone in rural districts, where in many cases, either no regulations at all have been made, or if made, have not been enforced. On the other hand in the majority of urban and suburban districts regulations have been made and enforced, with the consequence that milking cows are now housed under far better sanitary conditions in towns than in country districts, and as a result, that cleaner and better milk is produced in the former than in the latter.

The result of this want of compulsion in dairy inspection would be farcical, were it not serious, for whilst cowkeepers in some districts house cows and produce milk under more or less stringent regulations with their accompanying expenses, in others, where no regulations are in force, and consequently no sanitary expenses incurred, farmers and cowkeepers keep cows and produce milk under conditions that leave much to be desired.

What appears to be wanted is to secure compulsory, reasonable, and uniform dairy inspection, and to have it carried out by practical dairy inspectors under a central authority.

In Italy such a system has existed some time, the inspection being carried out by veterinary officers of health. The Legislative Assembly of Victoria, Australia, has lately passed an Act regulating the production and sale of milk and dairy produce, and enacting the most stringent regulations towards securing the purity and excellence of those commodities. The administration of the Act is vested in the Minister of Agriculture and the local authorities. Inspectors and supervisors for the carrying out of the law are appointed by the Government itself. The duties of these officers are specifically defined, and are of a friendly and advisory character, but they also include the strict supervision of the dairy farms. These and also butter factories must be annually licensed. All cows are to be carefully supervised, and power is given to prohibit the sale or other use of any cow whose produce is used for dairy purposes, the result of which

may be deleterious to health or in any way unwholesome. Certain diseases of cattle are notifiable, and provision is made for the isolation of affected cattle. Various regulations deal with the employment of persons engaged in the dairying industry to ensure freedom from contagious or infectious complaints when handling cattle or their produce. Ample powers are conferred on the supervising officers to ensure complete aseptic conditions and for a supply of pure water, so necessary where butter is concerned. Many other provisions are of extreme interest, one, for instance, being that of establishing model dairies in the various municipalities. Various other regulations deal with many miscellaneous matters, such as the standard or test to be applied to milk. The whole of this enactment is enforced by stringent penalties, and when it is in force Victoria can claim credit that it has, so far as human foresight can provide, a law which enables the purchaser of any dairy produce from that State to rely on having a pure, genuine and unadulterated article.

Were some such Act of Parliament in force in this country it would no doubt be possible to obtain a supply of pure milk, but owing to the increased cost necessary for compliance with such regulations it is questionable whether milk could be supplied at present prices.

Unfortunately it is the poorer people in our large towns who now get the most impure milk, and if the price was raised they would, whilst getting a purer milk, certainly be obliged to get less in quantity.

Municipal Milk Depots.

It is probable that the question of supplying pure milk to the poorer classes will have to be dealt with by the establishment of municipal milk depots. Veterinary inspectors will probably not be called upon to interest themselves much in connection with these, except so far as seeing that the milk supplied to them is produced under cleanly conditions from healthy cows, housed in sanitary cowsheds.

The questions of sterilisation, modification, humanisation, etc., of milk have been purposely left out of this paper for two reasons, first, that they are matters more concerning the province of the medical officers of health, and secondly, that they are processes dealing with the alteration of milk for special purposes, and have little to do with the production of milk, or the prevention of contamination in collection and transit.

[*For Discussion on this Paper, see page 689.*]

THE HYGIENIC CONTROL OF THE MILK SUPPLY.

By WILLIAM G. SAVAGE, B.Sc., M.D., D.P.H.

Medical Officer of Health, Colchester.

(MEMBER.)

THAT the present conditions under which milk is supplied are unsatisfactory from the hygienic point of view need not be laboured, it is well known. The recognition of the evil demands consideration as to how to remedy it. Some with a touching faith in the power of education believe that when the state of affairs is more widely known amongst consumers, matters will adjust themselves, and education is all that is needed. Others at the opposite extreme—at present voices in the wilderness—cry that no remedy short of the municipalisation of the whole milk supply will avail.

Between these two extremes are those who consider either that a better enforcement of present powers, or the addition of fresh ones, are measures adequate to give the necessary protection to the public.

Whatever be the remedy it is certainly for medical officers of health and those interested in sanitary progress to discuss together these matters, and if possible to arrive at united opinions. We cannot expect fresh laws if experts on the subject are at variance.

I think there can be no doubt that the present legal enactments are insufficient to preserve the purity of milk. Rural authorities are not inclined to go to the expense of seeing that all milk is produced under the best conditions, and there are no powers to compel them to do so; cows can be diseased and still be used for milking purposes, etc. In these and many other directions alterations in the law are required, but there is considerable difficulty in saying what steps are practicable and beneficial to the public. No doubt, medical officers of health could draw up regulations which would effectively control the milk service, and establish

a pure milk supply, but we have to consider what measures are likely to be considered by Parliament, and we must avoid, if possible, any steps which would cause an increase in the retail price of milk.

As practical men working amongst a conservatively minded people with a genius for compromise, it is obvious that when fresh legislation takes place it will not be a complete change, but the alterations of existing enactments.

Short of drastic alterations there are, however, a number of comparatively simple powers wanted which, while not burdensome or unduly restrictive, would yet materially improve the condition of vended milk. I do not advance the following considerations as in any way a complete solution or as altogether new, a number of them have been advocated before, but as stated above we need a united front, and a united and therefore authoritative opinion, and to obtain it, frequent discussion among ourselves is imperative.

(1) The present state of affairs whereby we have to register any cowkeeper, dairyman or purveyor of milk who applies, is most unsatisfactory. Their premises may be unsuitable, but the only course is first to register them, and then take proceedings for contravention of the Dairies, Cowsheds and Milkshops Orders, or of the regulations made under them.

We require powers to prevent the registration of unsuitable premises. The present method may seem efficacious, but everyone with practical experience of sanitary authorities knows that there is a vast difference between taking action against an accomplished deed and action to prevent a thing being accomplished.

What seems to me to be required is a definite enactment that no persons shall be registered until their premises have been licensed and certified to be suitable, in accordance with the regulations of the local authority, and that such licenses be not granted for more than three years. Such powers should not be burdensome, and they would ensure periodical inspection. In particular they would, I believe, largely aid in the prevention of the sale of small quantities of milk from small general shops. As we all know, a large amount of milk is so sold; such shops are often dirty, dusty and ill-ventilated, and altogether unsuitable for the sale of milk. At present it is not easy to take action against them, but if every such place had to be examined, reported upon and licensed, it would be easy to oppose the granting of licenses, and most of them would be suppressed. It will be urged that this enactment will make no difference in rural districts, since licenses will be granted without adequate inquiry.

That may be so to a considerable extent, but not in all, while it is chiefly in urban districts that it would be of most importance.

(2) I hope we are all agreed that the use of any preservative in milk should be prohibited. I do not propose to discuss this question, but it seems to me a most necessary factor in obtaining a pure milk supply.

(3) The adoption of regulations under the Dairies, Cowsheds and Milkshops Orders should be made compulsory and a certain minimum of adoptable regulations framed, including those for the simple cleansing precautions necessary to be taken at milking to insure a clean milk.

It will be said that these will not be enforced in the majority of rural districts, and at first no doubt this will be the case. They will, however, be carried out under some authorities and will clearly show what are the simple necessary precautions. Their insertion has also another use as will be shown directly.

(4) In view of the fact that in a number of instances slight udder or teat affections have given rise to extensive outbreaks of sore throat or other disease, while we have no powers to prevent such outbreaks, it is necessary that further powers be obtained to deal with such conditions. I think that all udder and teat diseases and all wasting diseases of any cow in milk, should be forthwith notified to the medical officer of health, and that no milk from that cow should be sold under a heavy penalty, until permission be given by the medical officer of health, or better a properly appointed veterinary surgeon. Powers to compensate for loss should be given. The extensive outbreak of septic sore throat at Colchester in April 1905,* will serve as an illustration of the need for such notification of udder diseases. The outbreak was traced to a cow belonging to one of the six farms supplying the milk. The cow was in a shed with the others, two quarters were apparently healthy, one was suspicious, while the last quarter was markedly diseased, yielding yellow-brown pus. If the condition had been notified to me on April 19th, when it was said to have been first noticed, this outbreak of at least 600 cases would have been avoided.

(5) The most important alteration in the law, however, in my opinion, is to give local authorities power to inspect cows and cowsheds outside their own districts. It is particularly in regard to the milk of large towns, much of which comes from long distances, that improvement

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* See *Public Health*, Oct., 1905, p. 1.

is urgently necessary, and I see no hope of improvement unless those who consume the milk themselves exercise power over its production. Human nature being what it is, it is not to be expected that a rural authority is going to spend a considerable amount of money in inspecting cows and cowsheds in its district, where many of the members have a pecuniary interest in the milk trade, and when all improvements are not for the benefit of themselves, but of some perhaps far away town.

The cost of the inspection, which is one of the factors in producing the improvement, should be, at least in part, borne by those who profit by such inspection.

I see no fundamental objection to a local authority having power to inspect all dairies, cowsheds and cows, and to collect samples of milk, from anywhere, provided that the milk comes into the district of that local authority for purposes of sale. If the conditions are unsatisfactory, then the local authority should have power to apply to a magistrate to prohibit the sale of that milk within their district until written permission is again given. Of course the milk producer or his agent must be served with notice to be present, and the local authority must be prepared to furnish definite conditions which, on being complied with, would entitle the milk producer to again send his milk into the district.

The powers of the local authority would simply be to prohibit the sale of the milk within their district. They would have no power to prosecute or to order any works to be carried out.

To carry out such a regulation it is obviously essential to have an additional clause that all milk vendors must send to the local authority a list of the sources of their milk and must keep it up to date by sending in lists of alterations.

The kind of results would be much as follows. Many of the cities and boroughs recognising the need for inspection would make use of this provision, and send inspectors to inspect the cowsheds from which milk came into their districts. Of course the visits would be surprise ones, and no doubt the bacteriological examination of milk would play a part in enabling authorities to select milk producers for inspection.

Those with unsatisfactory premises, or premises which showed no evidence that they complied with the regulations in force, would be cited to appear, and the sale of their milk would be prohibited.

The milk seller would either—

Send his milk elsewhere; or ask the local authority what they required him to do.

As a result the borough would frame regulations embodying their requirements, and I believe there would be a rapid conformation to them.

The inspector or medical officer of health would no doubt—

> Send a list—a "black list"—of the suspended cowkeepers to other local authorities for their information; and would report the non-compliance of the milk producer to the local authority in whose district he is, calling their attention to the breach of their own regulations.

In addition to the above, fresh powers to enable the effective cooling of all milk, which has to undergo train transit, is necessary. For all milk coming into a city or town by train it would be a sufficient objection to allowing that milk to be admitted, that there were no proper cooling appliances on the farm.

In a number of other directions, particularly in regard to better means for preventing the sale of infected milk, more powers are required; but I have mainly had in view measures to mitigate, if not obviate, the general bacterial contamination of milk which is now se extremely common.

[*This Discussion applies also to the Paper by* MR. J. S. LLOYD, *page 676.*]

PROF. F. HOBDAY (London) said that Mr. Lloyd had told them that "the aim of all sanitary authorities, whether state or municipal, must be to see that milk was produced from clean and healthy cows, housed in clean and sanitary cowsheds, provided with good food and pure water, attended and milked by clean and healthy attendants, etc." How was this to be done? Common sense told them that it could only be efficiently carried out by the compulsory inclusion of the veterinary inspection of the living cows. No one was so qualified to inspect cattle as the veterinary surgeon; in fact, to have cattle inspected for the presence of disease by any other person reduced the thing to an absurdity. Yet how few towns, comparatively speaking, had this proper inspection! It seemed incredible that a country like England, a country which prided itself on being the premier country of the world in sanitary matters, should not have been the first to take steps to secure clean milk and wholesome meat. England was years behind Germany, France, Italy, and even little countries like Denmark, Belgium and Switzerland. It was of no use to issue regulations which the local authorities might (or might not) carry out. In country districts the members of the local

authorities were often owners of dairy cattle or interested in them, and they knew full well the extra trouble they, their friends, or perhaps a large number of their constituents, would be put to if these regulations were carried out. The consequence was that they dared not, or did not, put the Act into force. The law ought to be compulsory and universal; to have it in force in one district and not in the neighbouring one only led to petty jealousies, and besides that, the authorities did not forget that the milk of a dairy was not usually likely to cause disease or trouble in their own district, because the milk was generally sent to some large town many miles away. Did it not seem irrational that men who, as Mr. Villar asserted a few moments ago, had not brains enough if hustled a little to recollect to wash their hands, should be thought good enough to deal intimately with the staple food of thousands of children? In the towns it was an essential condition of all buildings where a number of men were employed that facilities for washing should be provided. It stood to reason that it was of primary importance in places where a milk supply was involved. It ought not to be necessary for such a demand to be made, it ought unconsciously to be the first thing to be thought of. He hoped that the resolution they would send up at the end of the meeting would be clearly and strongly worded.

Mr. Robert Lambil (Lanarkshire C.C.) argued that local authorities should see that all persons milking cows and handling milk kept themselves clean in person and clothing, and that all places where milk cows were kept or milk was stored or sold, were in a first-class sanitary condition, with a constant current of pure air in circulation.

Dr. J. R. Kaye (West Riding C.C.) agreed that education was a main factor in the improving of cowshed sanitation. He pointed out that the West Riding County Council possessed a training farm, and issued detailed suggestions for cowshed premises, and placards for hanging in the shippon. Milk was also examined in the health department bacteriology laboratory, so too was water from farms. A conference was also about to be held on milk contamination. In these ways it was hoped the milk supply was improving in the West Riding.

Sir Charles Cameron, C.B., (Dublin) gave an account of the inspection of cowsheds, cows, and milk stores in Ireland. He had induced the Corporation of Dublin to appoint a whole-time veterinary surgeon to examine the dairy cows and their sheds. He had a staff of four inspectors. He found that the milk from the Dublin cows was much freer from dirt than the milk which came into the city from country districts. In the latter the inspection of dairies and dairy yards was very imperfectly carried out, as the poor law officers were *ex officio* the medical officers of health, and were paid absurdly small salaries. When a medical officer of health received only £10 a year he could not be expected to

show enthusiasm for sanitary improvement. The Board of Agriculture in Ireland had a staff of 50 veterinary surgeons, and a large number of inspectors. They were engaged in carrying out the provisions of the Diseases of Animals Act, which was also in part entrusted to the sanitary authorities. He suggested that the Board of Agriculture should administer the Act aud Cowsheds Orders altogether, which would insure a thorough inspection of the rural sources of milk, which was now practically completely neglected. The staff of the Board would have to be increased, but he ventured to think that the veterinarians would not object to that.

DR. T. VALINTINE (New Zealand) said that from the remarks of previous speakers it would appear that in New Zealand there were better facilities for controlling the milk supply than existed in the mother country. That these facilities existed was largely due to the fact that dairying was one of the most important industries of the colony, and was in active competition with other countries for the trade of the old country. The colony could not afford, therefore, to conduct the dairying and export meat industries in an insanitary manner. Practically the legislation suggested by Dr. Savage to improve dairying in this country was in force in New Zealand, though it was to be regretted that the Acts were not always put into operation. He did not agree with Dr. Savage that little could be done by education. His experience was that if the public could be once made to see that they were taking in their milk, filth organisms that would never be tolerated in a public water supply, a great step would be made. Relying on an educated public, his Department was about to try a classification of dairies, only giving an A certificate to those dairies where the cows were certified healthy by veterinary surgeons, and where all the condtiions as to milking, storage, and transit were carried out under the best possible conditions. He agreed with Dr. Savage as to his remarks concerning preservatives and the notification of udder disease.

DR. F. E. FREMANTLE (Herts C.C.) said that three points might be briefly suggested: (1) Control should primarily rest with local sanitary authorities, supervised by the county councils. The consuming districts should have power to inspect production outside their own area, only in conjunction with the county council authorities of the producing districts; existing boundaries must be respected, otherwise smaller and less keen county councils would entirely slink out of their responsibilities. (2) Rapidity of transit was of great importance, in order to reduce time for incubation of organisms existing in the original milk, and to lessen opportunities for pollution on the way; as at Chicago, the railways might be induced to give a good train service to insure the morning's milk being consumed in the evening, the evening's milk on the following morning; for this purpose it would be well to label every can of milk with the hour and date of milking. (3) Co-ordination of milk collection, as in the *laiteries* in the

country round Geneva, benefited the farmer, and enabled the health authorities to trace up an impure milk infallibly to its source.

Mr. J. C. Coleman (Swindon) referring to Mr. Lloyd's paper and the cleaning of milk, said he had with him a sample of the refuse obtained from milk, after it had been sent to a dairy for sale. By the kindness of Dr. Newman Nield, he submitted a sample of the residue to microscopical examination, and found it contained blood corpuscles, fibrin and vegetable cells (fæces), pus cells, squamous epithilium, hair, fat and colostrum. The improved sanitary condition of the byres and yards he looked upon as a most imperative matter to be considered, and he would like to see the store heaps of manure removed outside the yards to at least 30 feet from any licensed buildings. It was absolutely necessary that the cows and byres be examined, say, once a month, by a qualified veterinary surgeon, and the milkers, their families, the dairy and the water by a medical officer. He thought a deal of contamination of milk took place on the railway platforms, when waiting for the milk train in the glaring sun often three or four hours; he would suggest that covered sheds be provided. He differed from Dr. Armstrong, as there was much more nutrient material in ripe grass than young grass. Dr. Fremantle, in suggesting that any local authority desiring to inspect in another district should do so in conjunction with the authority of that district, was probably unaware of the fact that when inspections were made the *local* authorities were usually engaged.

Dr. E. Davies (Swansea) suggested that the law relating to inspection of milk and cowsheds was inefficient, that it should be compulsory and general, that a more general use of the refrigerator immediately after milking and during transit would be beneficial, and that power should be given to local authorities to inspect cows and cowsheds outside their own districts.

Dr. Rideal (London) urged the desirability of the Board of Agriculture fixing limits as to the amount of straw, cowdung, and cocci in a public milk supply. Such limits, if fixed under a Board of Agriculture Order (Sale of Food and Drugs Act), would enable local authorities to insure convictions when such foreign ingredients were present in the milk.

Miss C. Cochrane (St. Neots) said small rural milk farms should be inspected. There was no inspection at present where milk was sold to neighbours and others, therefore there was seldom any pure milk in villages for children, and often no milk at all; but there were very dirty conditions, bad water, and diseased cows.

Dr. Gerard C. Taylor (Finchley) drew attention to the increasing practice of milk vendors sterilizing and pasteurizing milk, and in some instances selling

the milk thus modified without notifying the fact. The strong evidence that pasteurized milk was not a suitable food for young infants emphasized the need for taking every precaution to insure a clean and otherwise pure milk supply, suitable for consumption uncooked.

DR. EDWARD WALFORD (Cardiff) said the organizers of this discussion were to be congratulated on having promoted the co-operation of the veterinary and medical professions. He had always advocated this co-operation in the administrative work of a sanitary authority, so far as this related to the supply of animal food to the public, and quite recently had induced the Cardiff Corporation to appoint a veterinary surgeon to undertake the inspection of meat and of cow sheds, which he thought might fairly be left to a well-qualified veterinary surgeon. He was inclined to attach considerable importance to the education of milk purveyors in this matter of a pure milk supply, and believed that county councils and borough councils might do more in this direction than they did at present through their technical instruction committees and schools. Farmers and others might be induced by education to appreciate the value of the cleanly, rapid, and cool transit by railway and cart of their milk. The present system of conveying milk in unlocked churns, placed in unsuitable and dirty railway vans, containing an assortment of articles (even dogs and other animals), should be prohibited. There could be no insurmountable difficulty in making arrangements for milk to be conveyed from the farm in hermetically sealed glass bottles and kept at a suitable temperature. If this were done the necessity for municipal milk depots would cease. With respect to the inspection of dairies and cowsheds by the officers of sanitary authorities outside their own districts, difficulties and friction might doubtless arise, but the question was one of great importance, and some way out of the difficulty might be found. Possibly the inspectors of the Board of Agriculture might assist in such cases. Fresh regulations would, of course, be necessary to insure these reforms, but he believed that, in the first place, those interested in the milk trade must be educated to see the value of such legislation, without which there was little chance of its being carried into effect. He was inclined to think that before new regulations were made, the milk supply of the country should be under the control of one central authority and not under two authorities as at present.

DR. W. G. SAVAGE (Colchester), in reply, remarked that many of the speakers had emphasised the value of education, and seemed to think that much improvement in the conditions of the milk trade was to be hoped for, merely from education of the farmers. For his part he was not so sanguine. Education certainly was valuable, but the law was an excellent, and in many ways the best, educator. In his own borough, he had no difficulty in enforcing the orders and regulations in force dealing with the number of cows in sheds, the structure of the sheds, etc.; but when he came to cleanliness in actual

milking, he had not been able to effect much improvement, and it was just for such matters that he had no legal powers. He could not help feeling that if these matters were compulsorily included in the regulations and he had the law behind him, much improvement would be effected. He was somewhat disappointed that there had not been more discussion over the broad principle as to whether local authorities should have power to inspect all cowsheds and cows outside their districts, as it was a highly important one. Two speakers had advocated that this control should be exercised by the county councils, but many of these bodies had not medical officers of health and were not in a position to undertake the work, while it could not be said that their composition altogether inspired confidence; and he was afraid that in many places they would be biased in favour of the producer rather than of the consumer. In regard to Dr. Rideal, he did not agree with his remarks at all. To take legal action upon the amount of cow dung in milk was not practicable, since the amount of dung to a considerable extent depended upon the efficiency of the straining, and a dirtily-produced milk strained two or three times would give better results than a much more cleanly milk, not strained or only once strained. Since the number of bacteria was not much affected by the straining, the latter milk would be better bacterially, but worse as measured by such a standard. In the same way streptococci were present in the majority of milk samples drawn from the healthy cow as he had already shown;* to condemn a milk because they were present was therefore absurd. We were not in a position at present to lay down bacteriological standards for milk, although he believed that in the future the bacteriological examination of milk would constitute a prominent part of the control of the milk trade, but much research was necessary first.

Dr. Henry E. Armstrong (Newcastle-upon-Tyne) agreed with the President as to the advantage of the combination of the sanitary and veterinary sections of the Congress in the present meeting. Legislation, which was largely under the direction of party politicians, was not of itself sufficient to provide for the proper control of the public milk supply. Neither was the action of the different Boards of the Government (Agricultural, Local Government, or other), all being more or less under the same bias. By none of these means could the London consumers of milk secure themselves against pollution of the milk sent to them from different farms and country dairies. County councils and rural district councils had no interest in enforcing necessary reforms on the tenants of such places, many of whom were members of these same sanitary authorities. Security might, in his opinion, be obtained by the establishment of a national representative board of all county, urban, and rural authorities entrusted with the duty of protecting the milk supply of the entire country, and having power to carry out all requirements to this end. Such a sanitary

* *Journal of Hygiene*, Vol. VI., page 123, 1906.

parliament could in the public interest deal with water and food supplies, vagrancy, vaccination, and other matters of national importance, for which party politicians had no time and little liking. The subject of milk supply was far too wide, and had too many sides, to cover in a meeting like the present. He advocated the license and registration of all dairies, and the compulsory education, training, and certification of all dairy operatives. The use of chemical preservatives of milk, such as were at present employed, was open to grave objection and abuse. But it was conceivable that other and harmless means of preserving milk from decomposition may be found which would permit the carriage of pure milk to towns from remote rural districts, and so lead to the production of a cheaper supply. At present one of the greatest anomalies in the milk trade was the fact that the quality of the article varies from day to day and month to month, more than any other article of food, yet the price remained a fixture. With regard to the spread of tuberculosis, the recommendation of the late Royal Commission to allow the sale of milk from a tuberculous cow, no matter how extensive her disease, so long as her udder is not visibly affected, could not be too strongly condemned.

RESOLUTION.

This meeting of Medical, Veterinary and Sanitary Officers is of opinion that the present legislation in relation to milk is inefficient, and that the enactments should be made compulsory and general.

The resolution was carried unanimously.*

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* Resolutions passed are referred to the Council, and their decision is given on page 606, No. 10.

THE SPREAD OF ANTHRAX IN ANIMALS AND MAN.

By JOHN DUNSTAN, M.R.C.V.S., F.R.S.Edin.

ONE of the chief reasons of the importance of anthrax is its communicability to man, the actual pecuniary loss from deaths of animals not being great in this country in comparison with other contagious diseases of animals. This loss, however, though small is increasing almost regularly every year owing to more frequent occurrence of the disease.

The Board of Agriculture statistics tell us that the average yearly deaths from anthrax in animals for the years 1887–8–9 were 194, and for the years 1903–4–5, 924—*i.e.*, nearly 4½ times as many cases occurred during the last three years. Not too much reliance should be placed on statistics, however, for various reasons, among which are the following:—

1. Unwillingness of certain local authorities to report, on account of the expense incurred in the disposal of carcases. This condition of affairs exists both in England and Scotland.

2. Landowners frequently object to their tenants reporting cases of anthrax, as the value of a farm on which anthrax is known to exist is thereby depreciated. Small landowners farming their own land frequently do not report for similar reasons.

3. Stock-breeders and feeders often do not report, for the reason that buyers are shy of buying from a farm on which anthrax has recently occurred.

4. Dairy-farmers object from fear of being temporarily prohibited from selling milk.

5. The occasional occurrence of an atypical case in which the disease is not suspected.

6. Cases are no doubt occasionally returned as anthrax which are not really so, owing to the difficulty of diagnosis when some considerable time has elapsed between death and examination.

Anthrax in Man is generally the result of infection from an infected animal, but it is necessary to recognize the possible saprophytic behaviour of the bacillus, and that it may be conveyed by soil, water, flies, dust, etc.

Man possesses a greater degree of resistance than most of the domesticated animals, and in him the disease runs a longer course.

There are three chief methods of infection: inhalation, ingestion, and inoculation. Perhaps errors in diagnosis are as frequently made in man as in animals, perhaps more so, errors being particularly likely to occur in ingestion cases, especially in districts where the disease is infrequent.

Infection by Inhalation is popularly known as wool sorters' or rag pickers' disease; these cases are not so frequent as formerly, owing to improved methods of dealing with wools, etc.

The condition is not easy of diagnosis, unless the history points to the possibility of anthrax, for this reason diagnosis is occasionally made too late. Dr. Bell of Bradford says: "Even when examined with great care diagnosis is frequently extremely difficult and nigh to impossible before the heart fails and collapse threatens. In ordinary cases where the patient survives from three to five days the symptoms for the first few days are so slight and so closely resemble those of ordinary catarrh that I do not know how a correct diagnosis can be made. In other cases heart failure is manifest at the commencement and diagnosis easy."

The characteristic symptoms are: difficulty of breathing, cough, cyanosis, sense of constriction of the chest; respirations 30–40; pulse 120–150; temperature 104°–106° F.; frothy bloody expectorate containing bacilli. Death usually occurs in from 24 to 48 hours.

Inoculation.—The lesion which results from infection by this method is popularly known as malignant pustule. There is no danger of inoculation if the skin be sound, but even a pin or thistle prick is sufficient to afford entry to the bacilli. An itching pimple with a dark centre and lighter areola first appears; the dark centre is soon covered by a small vesicle, the contents of which are at first clear but later bloody. The vesicle dries up in a day or two; becomes firm and hard and suggests gangrene. The swelling extends for half to three quarters of an inch, and a row of new vesicles appears which is followed by a necrotic slough, the lesion gradually extending in this manner. The necrotic part remains firmly adherent to the subjacent tissues until suppuration, which takes place in favourable cases, ensues. In addition to these local manifestations, fever, with its accompanying symptoms, is always present.

Anthrax Oedema may result from direct inoculation or in the course of internal anthrax. A flat swelling occurs which extends rapidly with a yellowish or reddish discolouration. It tends to speedy general infection.

Ingestion. Intestinal Anthrax.—The history of ingestion of anthrax

products assists diagnosis; possibly for some days there may be indications of local bowel lesions, chills, fever, nausea, etc. Suddenly the following occur: vomiting, bloody diarrhœa, anxiety, debility, cyanosis, and may-be petechiae, convulsions, nervous symptoms, and collapse; the bacilli are not always found in the circulating blood, but always in the sanguinary excretions.

Dr. Legge, H.M. Medical Factory Inspector, states that in this country, during the five years 1899—1903, 211 cases of anthrax in human beings were reported, and that the death-rate was 26 per cent.

The seats of infection were as follows: internal, 5; neck, 84; face and head, 77; forearm, 16; fingers, 1; elsewhere, 28. The pustule was excised in 143 cases, and the greatest death-rate occurred in those cases in which the primary lesion was on the neck, face, or head; 72 of the infected persons were wool workers, 56 of these working on wools classed as dangerous; 58 were workers in horsehair, and 69 workers in hides and skins.

Among the operatives working on wools scheduled as dangerous, 1·3 per cent. were infected, and on dangerous hair 1·5 per cent.; 34 per cent. of reported cases occurred amongst workers in Persian wools; 22 per cent. Turkish and Van mohair; 28 per cent. Chinese horsehair; 21 per cent. East Indian horsehair.

Recovery may, in the majority of cases of human anthrax, be confidently looked forward to if treatment be adopted in time. Sclavo's serum is now used largely and with excellent results.

Dr. Legge, in his Milroy lectures, says: "Many cases of cutaneous anthrax recover spontaneously, more recover after excision, and still more if, in addition to excision, Sclavo's serum be used. The serum should be used in all cases of internal anthrax, and in all cases where persons exposed to possible infection are taken ill, unless anthrax can be positively excluded. 40 cc. of the serum should be given, and repeated if necessary."

Notification of Anthrax.—The law directs that all cases of anthrax in animals shall be reported, but not so anthrax in man. Under the Factory and Workshops Act, 1901, all cases of *industrial* anthrax have to be notified. This is not as it should be; *all* cases should be reported. Numerous cases are on record where factory workers have conveyed the disease to friends and relations by means of their clothes, etc. If a wool or skin worker contracts anthrax it is notifiable; if, however, a member of his or her family becomes infected through their clothes, notification is not necessary.

A carter may convey infected wool or hides to a factory and contract

anthrax from handling the goods; in this case, however, notification is not necessary, and the wool or hides go unsuspected probably to infect other persons, and the vehicle perhaps to convey grain or other food materials. Neither the Home Office nor the local authority has power to deal either with cargo or wagon.

The Home Office is now issuing to all establishments dealing with raw animal products an illustrated placard prepared by Dr. T. M. Legge. On the top are three pictures depicting a malignant pustule of (*a*) one or two days, (*b*) three or four days, (*c*) later development. Below is a clear description of the disease, symptoms, causes, means of avoiding, and treatment.

Disinfection.—This is by no means an easy matter in the case of animal products. It is not practicable by means of chemicals, and heat sufficient to destroy the bacilli is only applicable in the case of horsehair. The hair is subjected to a current of steam between 200° and 225° F. at 2 to 2½ lbs. pressure. In the case of the other materials, close-fitting washable dresses, with gloves, veils, and respirators, are useful as indicated in the particular methods, and appliances for the prevention of dust, or for the collection and destruction of dust, and manipulation as far as possible of materials in a wet condition are about all that can be done.

This brings us now to a consideration of what might be done to lessen the frequency of anthrax both in man and animals.

First, then, we would say compulsory notification of *all* cases of anthrax in man. All cases in animals are reported, or at least are supposed to be. There is a wide-spread popular idea that anthrax only affects cattle; it is probable, however, that many animals of other species die of it, the cause of death being unsuspected.

Then some special means of dealing with those animal products which may be classed as dangerous should be compulsory.

All cases of sudden deaths in animals should be reported unless it is quite certain that anthrax is not the cause of death. All suspected cases should be reported directly to the veterinary inspector by telegraph. I have known numerous cases where an animal has been found dead early in the morning, and the farmer has reported to the village constable fairly promptly; the latter then gets into his uniform and starts off to walk to the nearest police inspector, who may perhaps live six or eight miles away, and this in spite of the fact that there is a telegraph office in the village (if he sends a telegram he must do it at his own expense). The police inspector then reports to his superintendent or to the veterinary inspector, so that by the time the latter receives his notification

evening has often arrived, and with it, in winter, darkness, which makes it impossible to dispose of the carcase on the day of death.

This importance of immediate reporting I would lay special stress on, both on account of the much greater ease of diagnosis, and of the great danger of leaving a carcase undisposed of longer than is necessary.

It is a wise proceeding for a veterinary inspector to take a field microscope with him when going to a suspected case: if he does this, and also uses the simple stain recommended by Sir John McFadyean, much valuable time will be saved, there will be less risk of error in diagnosis, and risk of spread of the disease by flies, birds, vermin and dogs will be considerably minimised.

The veterinary inspector occasionally meets with a case in which the animal has been dead for some time. I myself met with a case a short time since in which death had occurred three or probably four days previously. In these cases, especially in summer, putrefactive bacilli may swarm in the blood to such an extent, and those of anthrax may have partially or wholly disappeared or may refuse to stain, that diagnosis is extremely difficult, even in the hands of an expert. In these cases the carcase should be dealt with as if death were certainly due to anthrax; in fact, the Anthrax Order of 1899 provides for the immediate disposal of such carcases as if certainly dead of anthrax.

There is reason to believe that animals dead of anthrax are occasionally sent to knackeries, and that the flesh is consigned to London as cats' meat, either partially cooked or raw. Some means should be taken to prevent the possibility of this, as the vans in which such meat is conveyed may infect other goods, apart from the infective nature of the material itself. With regard to the disposal of carcases I have carefully studied the method of Major Bostock, now advised by the Board of Agriculture, and can speak of it in terms of unqualified approval, having watched the destruction of several carcases. No attention is required after the fire has been set alight, everything is consumed, there is not the slightest possibility of any infection remaining, the method is not expensive, the cost being very little more than that of burial.

[*The Proceedings of the Congress will be continued on page 701.*]

Volume XXVII. No. 12. Issued January, 1907.

JOURNAL
OF
THE ROYAL SANITARY INSTITUTE

CONGRESS AT BRISTOL.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By A. E. HUDSON,
Chief Sanitary Inspector, Cheltenham,
(MEMBER),
PRESIDENT OF THE CONFERENCE.

IT is not my intention to occupy at any great length the time of the Conference by delivering a long address, it is rather my desire to direct your attention briefly to a few points connected with the housing question, which if not entirely new may perhaps have some interest for you.

There can be no doubt as to the necessity of the systematic supervision of dwellings and workplaces by sanitary officials. Attempts by each private individual to protect himself against influences adverse to health are extremely liable to be frustrated by the acts and omissions of his neighbours, and he must consequently rely upon the local governing body for aid in the matter, that body acting by its trained officials. Local authorities, through their officials, can put into force the powers they possess to provide against overcrowding, to secure good ventilation, access of light and freedom from damp in all dwellings or workshops. They can clear out all crowded sites, remove all obstructions to the free passage of air, and, by the modification or reconstruction of insanitary house property, they can do away with the slums and phthisis nests which now abound in most of our large towns. In all these matters we have to bear in mind to what an extent the public and each individual are dependent upon sanitary officials to prevent and ameliorate the insanitary conditions which are

often hurtful or even fatal to life, and are, moreover, opposed to that simple comfort upon which depends in so large a degree the happiness and contentment of humanity.

A great part of our population still dwells in a state of misery and social degradation, and this is the class who benefit most by the visit of the sanitary inspector. The conditions found to exist are often of a disheartening character, and sometimes our labour seems almost barren of results, owing mainly to the indifference of the people themselves, their careless methods of living and improvident habits; but perseverance in the work is in the end bound to be productive of good.

The domicile has occupied much of our attention. In the houses of the people our efforts have been directed to secure for the inmates sweet, clean, healthy homes, which they can occupy with the greatest amount of comfort and freedom from disease. The best results of our work are to be found here, and I think that in this connection we may claim to have done our part in the reduction of the death-rate as well as in the reduction of the sickness rate, a reduction of the latter being a matter of quite equal importance to a lowering of the death-rate.

The great amount of work that it is possible to do in a quiet routine way in a health department, as apart from any schemes for demolition and rehousing, becomes apparent if at the end of each year an estimate is made of the cost of the improvements made under notices specifying amendatory works. In most towns of any size many thousands of pounds are spent annually in this manner, and I take it that this stands for more real sanitary improvement than is often affected by the adoption of some of the clearance and rebuilding schemes which have to be carried out at the public expense, and which by failing to provide houses for the same class of tenants as those unhoused are not always an unqualified success.

People now live longer and healthier lives than was formerly the case, but that a large number of our population still live under conditions that are discreditable to modern civilization may be proved by comparing the relative healthiness of two wards, A and B, in the same town, one being composed largely of houses of the well-to-do, and the other chiefly of those of the working classes and the poorest poor. The population of each ward is about 10,000, the death-rate in ward A is 10 per 1,000, in the other it is 20 per 1,000, or double. When we examine the zymotic death-rate the difference is greater still, that in A being ·5, and in B 3·20. The phthisis death-rate is ·51 in the former to 1·75 in the latter, and the infant death-rate is 98 as compared to 169. The contemplation of these great differences between the chance of life and health as exhibited in a poor ward

and a well-to-do ward, plainly suggests how much still remains to be done and what it is possible to do in fighting evil influences.

There can be no doubt that the housing, environment, greater cleanliness, better food, and the more temperate habits of the better classes, as compared with those of the poor, associated with the nature of the employment of the latter, exercise a considerable influence in respect to the relative healthiness of the two districts. What is true of this one town is true of most great towns. The penalties paid for overcrowded and insanitary homes are consumption, high rate of infantile mortality, high general death-rate, fever and other epidemic diseases, increase in crime and vice, intensification of tendencies to drink and gamble, and general physical deterioration. Prevention is far better than cure. To secure healthier people we must have healthier homes. To secure healthy homes we must have dwellings to which air and sunlight have easy access.

The housing of the poor is far from being satisfactory in any town or city. Bad housing is recognised as one of the principal causes of the existing vice and wretchedness of the poorest poor. I am not suggesting that there is no housing question in respect to the artisan, but my experience leads me to think that the urgent problem which faces us has reference to the housing of the poorer labouring classes.

Undoubtedly one of the most promising of all reforms lies in the direction of house improvement for the lowest class of the population. Much praise is bestowed upon the open-air treatment of tuberculosis, and the provision of sanatoria for the treatment of consumptives. But to remove causes is more salutary than to treat effects, and better results might be expected by preventing overcrowding in the homes of the poor, and so removing the cause of tuberculosis and of much other disease.

But no profit or credit to any individual attaches to this latter process; there is no object in advertising it, as in the case of a private establishment for the cure of disease, and consequently it has taken a less firm hold on the imagination of the public.

The provision of better houses for the poor, moreover, can only be made by some sacrifice on the part of the ratepayers, and this fact, as soon as it comes to be appreciated, detracts greatly from the popularity of the subject.

The dwellings of the poor require to be improved in several particulars, but the main particular is in regard to size. Larger houses are required, and it is useless providing new houses that do not afford much greater accommodation than the existing houses, which are far too small. The limit of air space generally agreed upon as that below which legal

action shall be taken to abate overcrowding, viz., 300 cubic feet of sleeping space for an adult, and half that for children under ten years of age, is not sufficient for habitual occupation, if we are to expect good health. Such a cubic area of breathing space is not at all what good sanitation demands, and the floor area of a house filled with occupants to this extent is so small as to render cleanliness almost impossible. This limit is fixed not by the requirements of sanitation, but by the driving necessity of taking cognisance of the innumerable tiny places which are in existence, and by recognising the fact that if the limit were raised to say 500 feet sleeping space, with a corresponding increase in size of living rooms, a large part of the poor population would be turned out of house and home on account of overcrowding.

The greatest difference between the houses of the rich and poor is that of space. A bedroom in a middle class house has not uncommonly a cubic capacity of 3,000 feet. This space in a poor house accommodates ten adults without being overcrowded, according to the limit of 300 cubic feet per person. And how does this appear in relation to the incidence and continuance of disease? I think it is safe to say that nothing that has yet been done in providing houses by sanitary authorities has had any considerable effect upon the great question of housing the poorest poor. What has been done has been to provide superior houses to let at a rental beyond the reach of the poorest and most needy, or to build as cheaply as possible small houses in which the accommodation is far too little, and which are consequently unfit for occupation by poor families.

Hitherto the houses erected by public bodies with a view of rehousing some of the population displaced by an improvement scheme have been too expensive. The breadwinners in such insanitary property are not as a rule skilled workmen, and most of them, even when the greatest care and economy are exercised, do not earn a really living wage. To close the houses of such people because they are insanitary, and to offer them other houses at a much increased rental, and often far removed from their daily work, is not seriously to improve the conditions of life of these people. To build houses that could not possibly be let under 4s. to 6s. a week, does nothing for a class of people who were formerly paying 1s. 6d. to 3s. Private enterprise has and will cater for the provision of the former houses, but what is required is to build good sized houses, with three or more bedrooms, to accommodate families consisting of four to eight children, and to let them at rentals of 1s. 6d. to 3s. per week. When the houses have been built only half the difficulty has been met, the remaining and probably the most important half being to get the right

people into them and to keep them there; and the tenants must include the worst, the dirtiest, and the least capable units of humanity. Because the first object of public health is not to provide for the good and religious, the dependable, the capable, the most intelligent and independent, but to improve the sanitary conditions of life where they are most deficient, apart from bad or good or moral desert, or ability to pay the rent.

To meet this want local authorities must be prepared from the outset to subsidise such properties from the rates.

Objections would no doubt be raised to the provision of such houses as I have described at the expense of the rates, as it may be urged that it would really amount to giving a rate-in-aid-of-wages; which would be a dangerous course, as it would have a tendency to attract people from country districts where wages are low, and it would also be likely to render the class of people who reside in these houses more careless and indifferent to paying their way, instead of developing the independence of the individual. The people to be provided for may be divided into two classes, (1) the incapable, unprofitable, out-of-works, the lazy, the physically unfit, the slovenly, the dissolute and criminal, and (2) the decent poor. The consideration of these two classes resolves itself into another problem, ought the honest unfortunate poor people, whose whole life is a struggle to keep body and soul together, and who cannot afford the rent for a decent house, to be compelled to live in the same locality as the destructive, dissolute, and disorderly? I contend that they should not. The latter should be compelled to live in houses suitable to their destructive habits, until they show by their conduct that they are fit to live in a better type of house amongst decent people. Objection may be taken to this proposal, on the ground of the invidiousness of the distinction to be made and the interference with the liberty of the subject. Liberty of the subject! The only liberty that I know of is liberty under law. Laws have been passed and are put into operation where necessary to prevent a person from obtaining strong drink by detaining them in a home, to punish tradesmen for selling adulterated or unsound foods, to secure the removal to hospital of a person suffering from an infectious disease. All these laws have been passed in the interest of the community and it is on these grounds that I suggest that the improvident, vicious and dissolute people should be housed in special dwellings and constantly supervised, until they show by their habits and conduct that they are respectable citizens. I mean that such dwellings should be provided and managed by the municipality under strictly observed by-laws.

Then as to those houses which we deal with in practice as being

overcrowded through giving a smaller sleeping space than the absurd minimum of 300 cubic feet per adult. These overcrowding cases are not always easy to detect and are always very difficult to permanently abate. What are the causes of this overcrowding? In looking into the cause in fifty cases which have in recent times come under my notice I find that the greater part of it is due to sheer inability on the part of the tenants to pay rent enough to secure adequate accommodation. Let me here give two cases to show this.

A house occupied by a steady, hard working labourer, his wife and family of six children. The wages of the man, who is the only wage earner, average 15s. per week. There are two very small bed-rooms with a total cubic capacity of 831 feet, whereas they ought to have (allowing 300 cubic feet per adult person) at least 1,800 feet. The man states he cannot afford to pay more than 5s. per week for rent. After paying this amount, it leaves 10s. to feed, clothe and provide all the necessaries of life for himself and family. This is equal to $2\frac{1}{8}$ of a penny per head per day.

Another case is that of a house with one bed-room divided into two by a partition, the cubic capacity of the whole being equal to 970 cubic feet. The occupants consist of a farm labourer, wife, three girls over 10 years of age, and two boys under 10 years. The man is the only wage earner, his wage averages 12s. per week, and he has to walk three miles to and from his work morning and night, being unable to obtain a house nearer his work. Rent of house 4s. per week. Amount left to provide food, clothing, fuel, etc., equal to two pence per head per day.

These are not isolated cases, and there is no doubt that there are thousands of families whose weekly income does not exceed 15s. per week. In many instances the income is as low as 10s., and even less. It is impossible for a vast number of the labouring classes to pay sufficient rent for a house to meet their needs, and to get sufficient food and clothing for themselves. Take the first case I mentioned of a labourer whose average earnings are equal to 15s.; after paying 5s. per week for rent, and assuming that nothing was spent on drink, tobacco or amusement, the remaining 10s. would fall far short of what is required to pay for food, clothes, light, coal, and other household expenses. This is one of the points of our social system that requires looking into more than anything else. It is a matter of the distribution of wealth, and nothing short of some sort of alteration in the distribution of money or means can ever permit the dwellings of the poor to be everywhere, such as, according to the dictates of hygiene, they ought to be.

In a good many cases, overcrowding is due to wasting the money on

drink and gambling, but after making allowance for all other causes, there can be no doubt that the smallness of the income is by far the most general one.

It would take me too far afield to discuss the cause of poverty and its bearing on the housing question, but undoubtedly the consumption of drink is responsible for a large amount of poverty, and it is a well-known fact that the deaths ascribed to alcohol in the death returns do not give even a remote idea of the correct number of deaths caused by the abuse of drink, and it is absolutely impossible to ascertain the amount of injury done indirectly to the public health from this cause.

After mature deliberation, I am prepared to submit that although there are houses that are unfit for people to dwell in, there are also people who appear to be unfit to dwell in houses. We can compel the landlord to cleanse houses, but we cannot compulsorily cleanse people, or make them more cleanly in their ways. A house, however large, must be insanitary if filthily kept, and many houses are kept in a filthy state. Perhaps the sluttish habit is an incorrigible one, but if it be amenable to improvement by precept or teaching, there is certainly a fine field for any persons who may feel themselves called to such a practical mission. We can insist upon the provision of sufficient window area, but we cannot make the occupier open the windows as frequently as they ought to do; we can provide means of ventilation, but we cannot prevent the openings from being closed; we can provide good sanitary fittings, but we cannot prevent them being damaged by destructive tenants. Parliament could pass acts giving powers to local authorities to improve the houses of the people, but Parliament could not make good men and women. So soon as we become a sober nation and give a living wage to the workers, we shall find the greater part of the slums and dens of infamy swept out of the country, as I am convinced that no honest sensible human being desires to live in slumland; and it is to the people we must look for reform, because if any permanent benefit is to be secured it is by changing the character of a man, where a man's own character and defects constitute the reason for his bad habits.

ADVANTAGES OF PUBLIC ABATTOIRS.

By GEO. H. ANDERSON,

Chief Sanitary Inspector, Middlesbrough.

(ASSOCIATE.)

THE advantages of public abattoirs as compared with private slaughter-houses are so apparent and numerous, that it is difficult to understand what arguments can be advanced in favour of the latter.

When the Public Health Act, 1875, was passed, the power of granting licenses and making by-laws for the regulation of slaughter-houses was conferred upon the local sanitary authorities, and from that time to the present a marked improvement has been effected; but, unfortunately, many of the older legacies are still with us.

The Public Health Acts Amendment Act, 1890, specifies that licenses granted by any authority after the adoption of this Act for the use and occupation of places as slaughter-houses shall be in force for such time only (not being less than 12 months) as the local authority may think fit to specify in such license. It also provides that upon change of occupation written notice must be given, and any person failing to comply within one month is liable to a penalty not exceeding five pounds.

Had this Act been retrospective, our duties would have been considerably lighter and the towns we serve in a much better sanitary condition, for many of the unsuitable structures now registered would either have been remodelled or the license refused when the time for renewal came round.

In the town that I represent we have three striking illustrations of the advantages of this Act. Licenses in congested parts of the town were transferred to suitable centres where the buildings are of a very superior character, and, as the licenses have to be renewed annually, we rarely have any fault to find.

The Public Health Act, 1897 (Scotland) goes a step further than ours, and requires that all private slaughter-houses *shall* be licensed annually. This has proved of the greatest advantage in Scotland, and we wonder why its excellent provisions were not also conferred upon England.

Another advantage that Scotland possesses is the Burgh Police Act, 1822, which specifies that when the commissioners (local authorities) have provided a public slaughter-house, no other place within the burgh may be used for slaughtering.

Now let us consider what advantage the public would derive by compelling all meat intended for human consumption to be prepared in public abattoirs. These abattoirs are, as a rule, lofty, well-ventilated, substantial buildings, kept scrupulously clean, and fitted up with all the modern appliances. They are provided for the benefit of the public without regard to profit, it being a rare occurrence to find a municipal abattoir that is self-supporting.

The animals brought to the abattoir are examined both before and after slaughtering, and are prepared in a manner best calculated to minimise the evils that are inseparable from the process, however careful the butcher may be; and it confines the nuisance and foul emanations to one place, instead of allowing them to be spread over different parts of the town as at present.

PRACTICAL TRAINING FOR SANITARY INSPECTORS BEFORE CERTIFICATION.

By W. W. WEST.
(ASSOCIATE.)

ABSTRACT.

ACQUAINTANCE with the proceedings of Sanitary Congresses, whether of general bodies like the Sanitary Institute, or of sectional bodies like the Sanitary Inspectors' Associations, affords ample evidence that they have kept prominently forward the desirability of trained as well as theoretically educated men.

The effect of this consensus of opinion has been, that gradually the two principal bodies engaged in the examination of inspectors, the Sanitary Inspectors Examination Board and The Royal Sanitary Institute, have come to admit the correctness of our view. The Sanitary Inspectors Examination Board requires one of two so-called evidences of practical training. The first is that the candidate must have held office for not less than three years.

This requirement is, to the extent of its possibilities, complete and satisfactory. Those of you who have had any extended experience, will agree that it is a useful preliminary to a technical examination and certification.

It is, however, so limited in its possibilities as to be largely illusory. Every year that elapses from that date lessens the likelihood that a candidate will possess the qualification, so that we are at last thrown entirely upon the other alternative (attendance at a Course of Lectures and Demonstrations), thus giving colour to the suggestion that the first was not inserted with the object of being of practical service, but merely as a "sop to Cerberus."

There remains, therefore, only theoretical teaching. In view of the greatly extended scope of the duties cast upon inspectors of late years,

it cannot be seriously contended that theoretical examination is sufficient evidence of qualification to fill the office. As we have seen, there is a large body of opinion to the contrary. It might naturally have been expected that having professed to acknowledge the necessity for practical training an alternative would have been insisted upon which would bear reasonable comparison with, and be an adequate substitute for, the excellent first suggestion; instead of which the authors of the scheme but "Keep the word of promise to the ear, and break it to the hope."

The Sanitary Institute is the body which has granted the greatest number of certificates of fitness, and it, likewise, has accepted the opinion so widely expressed, as to the need for previous practical training, and has admitted thereby, that in the opinion of its Council, attendance at its lectures and demonstrations is not alone sufficient to justify a certificate of fitness for office.

What, however, is the training required? Is half an hour's walk through a district in company with the sanitary inspector in the course of his visits sufficient practical training? I say not, and I am sure you will agree.

Is anything required of candidates that is at all comparable with the three years' experience required by the first suggestion of the Sanitary Inspectors' Examination Board? Even supposing that two afternoons a week for a month are given to such training, can it compare with the former?

Seeing then that the Sanitary Institute has acknowledged that its theoretical training is not of itself sufficient to justify certification, let us for a moment return to the Examination Board. They require as their alternative to experience in office that the candidate should attend an approved course of instruction consisting of not less than thirty-two systematic lectures, supplemented by demonstrations, and comprising the subjects of the technical examinations.

It will be noted that any course of lectures and demonstrations must be approved by the Board before it can be accepted as satisfying their requirements as an efficient substitute for practical experience, and we know that in practice this resolves itself into a syllabus drafted in co-operation with the Board.

The Board being constituted as it is, it is not surprising that the course of such instruction given by the Institute should be approved, and you will see at once the peculiar position into which we are landed, justifying completely the contention that the second alternative is not a satisfactory one, not comparable to the first, inasmuch as it stands self-condemned.

A course of theoretical instruction, which is admittedly not sufficient to justify certification by the Institute, is accepted as a sufficient substitute for the three years' actual official experience of the Examination Board.

I am not desiring to say anything which can in any way be construed as finding fault with either of the authorities who have had in hand the certification of Inspectors, least of all with The Royal Sanitary Institute. The pioneer in the work, the chief and for many years the only body taking active part in it, nothing but gratitude and admiration are due from all of us for what it has done in this direction and still continues to do.

Nevertheless, we are justified in pointing out, as opportunities offer, the direction in which advance ought in our opinion to be made, and urge upon them to-day, as in the past, to use the very great influence which they possess to bring into actual operation the condition of affairs which they have recognised as right to be secured. Of this I am satisfied: if they are determined on the matter, it could be done.

The Examination Board, by their first requirement of official experience, and the Sanitary Institute, by their acknowledgment of the necessity for practical training, have promised the public, and created an expectation of, that experience or its equivalent, and it is the duty of both bodies to take steps to secure that it should be provided.

An honest attempt to secure this practical experience in candidates has been already made by The Royal Sanitary Institute, in circularising local authorities to allow intending candidates to accompany inspectors in their duties, and thus obtain actual acquaintance with the work; but there are several reasons why this arrangment is not likely to be successful.

In one very important direction no endeavour has been made towards success. Not the slightest attempt has been made to secure the support of inspectors in the matter. Ignore it as one may, it is impossible to deny that the persons who will have to instruct are those who are carrying out the duties. There are inspectors in office by the thousand who are associates of the Institute, but no effort has been made to secure their co-operation.

Again, there is no definition as to what is meant by "opportunities of gaining practical experience." It may mean anything from half an hour to half a year; and I feel sure that you will agree with me that neither of these would be an honourable compliance with the expectation raised in the minds of the public by a promise of practical experience.

Further, authorities object to unofficial workers taking up the time of their officers for any lengthened period, or being put upon any duties

which shall give them entry into premises or information as to conditions in the life and circumstances of the ratepayers.

A variety of suggestions has been made for securing this practical training, but it seems to me that a slight alteration of the first requirement of the London Board would meet the case.

There would appear to be nothing unusual or oppressive about such an arrangement.

An authority requiring a clerk, surveyor or accountant, for instance, looks for him amongst those who have not only a theoretical knowledge, but who have also acquired practical experience as a subordinate in one of those departments.

There can then be no objection to a similar arrangement for those who have to be certified as qualified for inspectors.

As I have already said, I am sure that if the examining authorities were determined to bring this about, it would be done, and if both of them insist that only those shall be certified who have the training indicated, arrangements will soon be made to that end.

COMMON FLOCK BEDS IN RELATION TO THE PUBLIC HEALTH.

By PETER FYFE,

Chief Sanitary Inspector, Glasgow.

ABSTRACT.

IN 1904, when The Royal Sanitary Institute held its Congress in Glasgow, in a paper on the subject of Wool Flock Beds, I drew attention to the extremely filthy nature of this class of bedding, in the earnest hope that the Government of the day would take steps to protect the public from the unrestricted distribution of such dangerous material. I was much too sanguine in my hope. It is because nothing has been done to prevent the free manufacture and sale of this unclean rubbish as bedding for the people that, after two years, I venture to open the subject afresh.

I will now lay before you the results of some experiments I have recently caused to be made for the purpose of showing anew the absolute filthiness of new beds which are being sold every day in the towns and cities of this country. For my former paper I purchased only one new bed in Glasgow; for this one I purchased four new beds at different prices, one in Glasgow and three in Bristol.

I will begin with the beds bought in Bristol, as probably the inhabitants of the town where we have met in Congress will be more interested in the beds their fellow-citizens are nightly sleeping on than in those 400 miles away.

Through the kindness of Mr. Kirley, the chief sanitary inspector, and a friend of his, I was able to purchase in Bristol and have transferred to Glasgow, three new wool "mill puff" or flock mattresses. They were bought in ordinary warehouses in the usual way, and no one knows, but

the purchaser, where they were bought or why. I labelled the three beds, 1, 2 and 3. No. 1 cost 7s. 6d.; No. 2, 10s. 6d., and No. 3, 9s. 6d. When these mattresses arrived in Glasgow I took a handful of the flock from each, put it in an envelope, duly labelled, and sent the three envelopes, carefully sealed, to the bacteriologist of the corporation of Glasgow (Dr. R. M. Buchanan) for biological examination. I thereafter despatched the mattresses to the sanitary wash-house at Ruchill, with instructions to rinse out the dirt from the flock in the most careful manner. In the case of each the following operations were carried out:—

The wool flock was taken from its tick, put into a clean canvas bag and accurately weighed. It was then (still within the canvas bag) put into a washing machine (which had been scrupulously cleansed), and rinsed for half an hour in 40 gallons of pure water at a temperature of 100° Fahr. Two Winchester quart bottles were then filled with this dirty water, one of which was handed to the city analyst, Mr. F. W. Harris, for analysis. The remaining liquid was then collected into a clean barrel, along with the liquid remaining in the flock inside the bag, which was extracted by placing the bag in a hydro-extractor. Thus care was taken to exclude any wool particles from the washings, only the dirt and filth getting through the bag. The liquid was then reduced by evaporation until it could all be contained in two quart Winchester jars, one of which I sent to the analyst, and the other is on the table before you. So that what you see in these four Winchester quart jars is practically *one-half* of the total filth found in each of the beds, Nos. 1, 2, and 3, Bristol; and No. 1, Glasgow. The four medium-sized glass bottles you see contain water from which all dirt has been removed by careful filtration. This I caused to be done, so that you might see how much of the darkness of the samples was due to dyes alone. The four small bottles show part of this liquid distilled, with both the dye and the filth removed.

In addition to these, I exhibit certain odds and ends, such as buttons, pieces of bone and strips of steel, &c., which were hand-picked from the flock of each bed. The presence of these, by no means downy substances, exhibits the carelessness with which flocks are made and the beds are stuffed.

Having now some idea of the processes through which each bed was put, and the meaning of the bottles before you, I direct your attention to the findings of the city analyst and of the city bacteriologist. But before doing so, I might mention that the flock of Bristol Bed No. 1, before rinsing, weighed 36 lbs., and, on being re-dried, came out at 30½ lbs., thus losing in the process 5½ lbs. of dirt. I show you in a small tin box

some of the filth, reduced to a black-looking paste. Bristol Bed No. 2, originally 49½ lbs. in weight, lost 4¼ lbs.; and Bristol Bed No. 3, originally 36 lbs., lost 3 lbs.

Let me now say a few words on the analyst's table of results. You will note at the foot of the table the average figures for Glasgow sewage before it enters the sewage purification works at the eastern end of the city. It will be seen that in every case under the eleven headings given (except in two, under the heading *Chlorine*), the unconcentrated washings of all the beds (that is, the fluid resulting from rinsing the flock in 40 gallons of water) are worse than the sewage, and that the figures for the concentrated or evaporated washings are out of all proportion to those for the sewage.

Consider first the results obtained from the unconcentrated washings. Here we have 40 gallons of pure water, in which the flocks are rinsed for half an hour, turning out in almost every particular more full of offensive organic matter than crude sewage. It may be objected by critics that there are weighty objections to the value of this method of comparison, as crude sewage is organised organic matter, whereas the fluid obtained by rinsing the flocks in 40 gallons of water may probably contain principally non-organised organic matter, that is, organic matter of a non-putrescible nature. I anticipated such a criticism, and requested Mr. Harris, the chemist, to give me his opinion as to this. He writes:—

> "I would emphasise the fact that in the analysis of any water or sewage it is generally accepted by analysts that, in the absence of salts of iron, the figure for the oxygen absorbed in three minutes (see column 3 of Table I.) may be considered as an index of the proportion of organic matter undergoing putrefaction."
>
> "Now this figure for the Glasgow sewage is 3·095 grains per gallon; the minimum corresponding figure for the flock-bed washings is 4·24 grains, so that this sample (No. 1) contains more organic matter capable of rapidly undergoing putrefaction than crude sewage. The corresponding figure for the other three unconcentrated washings is more than twice this amount."

It will, I think, be almost universally admitted that another analytical figure of importance is that showing the *albuminoid ammonia*. This figure is an index of the proportion of nitrogenous organic matter contained in the sample under examination. Here, again, every one of the unconcentrated flock washings shows an excess over that of the crude sewage. On this point also I asked the chemist to give me the value of his expert opinion; he writes:—

> "I hold that the high albuminoid ammonia figure, even of the unconcentrated flock-bed washings, is derived almost entirely from dirt, etc., that

is, from extraneous matter contained in the bed material. In support of this opinion, I give some figures of a paper-mill works waste liquid:—

Albuminoid Ammonia ..	0·085
Dissolved Solids—	
Mineral	2·87
Organic	1·47
Total	4·34"

Here we have a paper-works effluent, after treating the raw material in boiling water with an alkali, in order to remove fats, resins, etc., and then washing the thus treated material with water. What must we think of the condition of a flock which, after only rinsing in 40 gallons of water, and without boiling or the addition of any alkali, produces a water containing such an excess of *albuminoid ammonia* and *dissolved solids* as we find in the table before us? Here is the analyst's conclusion. He says:

"Comparing these figures with the results of the analysis of the unconcentrated flock-bed washings, I think it is plainly obvious that the excessive quantity of organic matter contained in these liquids must be derived from organic matter *extraneous* to the clean material comprising the bed flocks, and is not derived from the intrinsic organic matter of the same."

Then, finally, he says:—

"In conclusion, I must emphasise that the analytical figures given in the table, with the exception of the suspended solids, were all obtained by the analysis of the *filtered* samples."

It is rather startling to think that hundreds of thousands of persons in this realm are nightly slumbering upon stuff, which, after rinsing in 40 gallons of water, would produce a liquid which, in respect of albuminoid ammonia and dissolved solids (to say nothing of colour), would not be allowed by law to be put into any of our streams or rivers. Yet such is the case, and we continue to speculate on the causation of various diseases, and to make Departmental Committee Inquiries into the deterioration of our race. Is it more important to safeguard the health of trout than that of men?

Every figure in the public analyst's table is a sermon against the continuation of this scandalous state of matters. I regret I cannot congratulate the people of Bristol on the beds purchased in their fine city. I thought Glasgow was bad, very bad, but taking the whole table, and particularly those certain indices of dangerous filth (the albuminoid ammonia and the oxygen absorbed at 27° centigrade in three minutes) Bristol bears the palm over Glasgow for filthy bedding.

Let me now turn, in conclusion, to Dr. Buchanan's report. His ex-

TABLE I.—*Washings from Bed Materials.*

(All Results expressed in Grains per Gallon.)

Description of Sample.	AMMONIA.		OXYGEN ABSORBED @ 27° C.			Chlorine.	SOLIDS IN SOLUTION.			SOLIDS IN SUSPENSION.			Re-action.
	Free.	Albuminoid.	3 mins.	15 mins	4 hrs.		Mineral.	Organic.	Total.	Mineral.	Organic.	Total.	
Glasgow Bed......	1·834	1·554	4·24	7·42	13·21	14·0	54·95	70·42	125·37	54·11	70·84	124·95	Alkaline
	3·830	28·550	121·45	190·40	428·75	80·15	1709·82	2362·71	4072·53	361·69	736·75	1098 44	do.
Bristol Bed, No. 1	3·03	2·21	8·64	15·52	28·78	16·8	130·62	165·06	295·68	53·62	66·20	119·82	do.
	42·14	56·70	152·60	266·21	593·25	99·25	2690·24	4188·24	6878·48	1263·22	2956·66	4219·88	do.
Bristol Bed, No. 2	4·20	5·50	9·10	17·22	35·91	3·5	50·86	88·48	139·34	14·14	37·59	51·73	do.
	49·70	89·25	192·5	303·10	630·0	20·6	3003·83	4847·50	7856·38	1109·50	2499·07	3608·57	do.
Bristol Bed, No. 3	3·22	5·77	10·29	17·29	41·44	11·2	48·72	163·52	212·24	64·12	174·20	238·42	do.
	16·83	24·26	177·45	281·40	664·65	70·35	1654·24	4780·16	6434·40	325·57	1068 62	1394·19	do.
Average Glasgow Sewage	1·23	0·407	3 095	......	7·125	12·2	50·36	37·65	88·01	12·4	11·9	24·3	Acid

TABLE II.—*Bacteriological Examination of Flocks.*

Date.	Number of Sample.	Source of Flock.	Price of Bed.	Bacterial Content per gramme of Flock.	Amount of Centrifugalised Deposit from washings of one gramme of Flock.	Coliform Organisms isolated from washings of 1,000th gramme of Flock.
1906. May 4	1	Glasgow New Bed, No. 1 (*not rinsed*)	9/6	22,100,000	Trace of black deposit entangled in short fibres	Bacillus of *lactis aerogenes* type.
„ 14	2	Bristol New Bed, No. 1 ...	7/6	3,070,000	1 cc. of dense black deposit ...	Do. Do.
„ 21	3	Bristol New Bed, No. 2 ...	10/6	10,500,000	0·25 cc. of greyish black deposit	None.
„ 21	4	Bristol New Bed, No. 3 ...	9/6	462,000	0·5 cc. of dense black deposit ...	Bacillus of *lactis aerogenes* type. & bacillus of *acidi lactici* type.
„ 22	5	Glasgow New Bed, No. 1, *after being rinsed, dried and teased.*	...	131,000,000	No black deposit	Bacillus of *lactis aerogenes* type.
„ 30	6	White clean Cotton Flock, No. 1	...	165,000	No deposit	Do. Do.
June 7	7	White clean Cotton Flock, No. 1	...	143,000	No deposit	Bacillus of *acidi lactici* type.

TABLE III.

Date.	Description.	Plate.	Time of Exposure.	Bacteria falling on Plates from air of Room before beating Bed.	Bacteria falling on Plates from air of Room after beating Bed.
1906. May 18	Bristol New Flock Bed, No. 2.........	I.	15 secs.	3	720
„ 18	Do. Do.	II.	30 „	6	1,332
„ 18	Do. Do.	III.	45 „	13	2,268
„ 18	Do. Do.	IV.	60 „	28	2,556
				= 2 per sq. in. per minute.	= 293 per sq. in. per minute.

TABLE IV.

Date.	No. of House and Bed.	Apartment in which Plates were exposed.	Quality of Bed, as indicated by Cost, etc.	Number of Bacteria falling per sq. inch per min. immediately before Bed-making.	Number of Bacteria falling per sq. inch per min. immediately after Bed-making.	Condition of Atmosphere after Bed-making.
1906.						
June 1	I.	Kitchen	7/9	2	61	Musty odour; dusty.
„ 1	II.	„	16/-	6	7	No perceptible odour or dust.
„ 1	III.	„	8/-	3	4	Slight musty odour; no perceptible dust.
„ 1	IV.	„	Bought second-hand	0·2	46	Very dusty; atmosphere smoky.
„ 1	V.	„	Bed much superior to others	0·3	3	No perceptible odour or dust.
„ 1	VI.	Single Apartment	15/-	0·8	3	Do. Do.

amination of the various flocks is not yet fully completed, but you have before you on Table II. the number of living germs or bacteria he found in one gramme of the flock taken from the heart of each mattress. As a gramme is ·035 of an ounce, you can easily understand that these figures may not give a true average of the number of bacteria in each of the beds, but they indicate sufficiently in each case the bacterial pollution which is present. They indicate, as Dr. Buchanan said in 1904 about the Glasgow bed, "an amount of uncleanliness in the form of *live potential dirt* that is shocking to contemplate, when one considers the purpose for which the material is used."

One gramme of Glasgow crude sewage contains on an average 197,500 bacteria, but, as you see by the Table, one gramme of the flock from the No. 2 Bristol bed contained no less than 10,500,000, while in the selected gramme of the Glasgow bed the vast number of 22,100,000 were found.

For comparison, I submitted two samples of white cotton flock (unsterilized) obtained from a manufacturer in Ayrshire. The bacteria found in a gramme of each of these samples were very moderate in quantity, being respectively 165,000 and 143,000. None of the wool flocks come near these figures.

I now direct your attention to No. 5 of this table. After the flock of the new bed purchased in Glasgow had been rinsed and dried, I sent the flock (which had been clumped by the rinsing) to be put through the "devil" again. When it came back from the factory, I handed a handful of the re-devilled flock to Dr. Buchanan for examination. It is obvious from the enormous number of bacteria now found in a gramme of the retreated flock, 131,000,000, that a very rapid growth had taken place, due probably to the presence of moisture in the flock after the rinsing process. This seems to indicate very strongly that rinsing alone in cold or tepid water, while it may remove much of the obnoxious filth, does not remove but rather increases the number of living organisms; hence it appears that sterilization by steam should follow washing, unless the washing is performed in a disinfecting solution.

I desired to know what was likely to occur when such beds were beaten in the presence of ordinary agar plates, so I carefully placed the No. 2 Bristol bed, as I received it, in its clean-looking tick, on the floor of a thoroughly washed room. I then closed the door for four hours, after which, accompanied by the chief and assistant city bacteriologists, I entered, and we placed four agar plates on a bench 18 inches above the floor and 9 feet from the bed. Before the bed was touched, these plates were exposed simultaneously, the first for 15 seconds, the second for 30

seconds, the third for 45 seconds, and the fourth for 60 seconds. These acted as controls.

The bed was then beaten with two sticks for two minutes, after which other four agar plates were placed in the same position, and exposed during the same periods of time. All the agar plates were then incubated for two days at 37° centigrade. The result of this experiment you have in Table III. The beating of the Bristol bed for two minutes had caused a fall of 291 microbes on each square inch in one minute. Only 2 per square inch per minute was the bacterial fall previous to the beating.

During the beating of the bed the air of the room was so polluted with the dust coming through the tick that, although our nostrils were plugged with cotton wool, we suffered both that day and the next from irritation of the air passages, my uvula being sore and much swollen.

Having thus ascertained the result of beating such beds on the atmosphere of a room, I conceived it might be instructive to find out, by direct experiment, what effect the ordinary domestic process of making such flock beds would have in a number of dwelling houses. Drs. Buchanan and Adam at once fell in with the idea, and prepared 12 agar plates of 9½ square inches in area, while my chief inspector in the central district made suitable arrangements with six respectable working class tenants in Bell Street. The houses selected were all of two apartments, except one, which was a large single apartment house, containing two beds. In each house the bedding was composed of wool flock, which had been in use for some time. All the houses were clean and bright. In each case the woman was told when we would arrive, and that she was not to make the bed until we came.

The first thing we did on arrival was to place the agar-culture plates on a table, six feet from each bed, and expose them, before the bed was made, for one minute, as a control. The housewives were then asked to make the bed in the usual way, after which the second series of plates were exposed for the same time. Both were then taken to the office and put into the incubator. The results are shown on Table IV.

The following are Dr. Buchanan's remarks upon this table:—

"It will be observed that there was an accession to the number of bacteria in the air of each apartment as the result of bed-making. This accession was by no means uniform, the number being increased 30 times in the case of Bed I., which was the cheapest, and 230 times in the case of Bed IV., which was bought second-hand, while the atmosphere was rendered disagreeable in both apartments. The superior beds, II., V., and VI., produced a relatively small increase, and it is noteworthy that the making of these beds caused no perceptible odour or dust. Bed III. appears ex-

ceptional, because, although of low price, it produced only a comparatively small accession to the number of bacteria. On the other hand, it gave rise to a musty atmosphere.

"The exceptional nature of the result in connection with this bed receives some explanation from a further inquiry which was made. It was then found that the flock was clean and of a good quality, and that the low price was attributed to the bed having been part of an upholsterer's stock, sold by auction for what it would bring. A bacteriological test of the flock from this bed gave results fairly approximating to those obtained in flock samples of the better quality represented in Table II., the number of bacteria being estimated at 710,000 per gramme of flock.

"It will be obvious from these results that the making of a bed under ordinary circumstances is attended with a temporary increase of bacteria in the air of the apartment, but it is also obvious that the contamination of the air in this series of experiments was greatest where the beds were of the poorest quality."

This experiment exhibits what I expected it would do. Beds of this character, quite apart from their mere dirtiness, have a potency for evil all unsuspected. What must be the conditions of milk, meat or soup stored in such houses in summer-time a few hours after such a bed is made in the same room? And, unfortunately, it is in the houses with no storing facilities for such foods that such flock beds are found.

I intimated already that Dr. Buchanan has not yet had time to make a full scientific analysis of the characters of the micro-organisms which were found growing so abundantly on his agar plates, but he told me enough to enable me to say that a large number of them are probably of the same species as are found in the human intestines. The suggestiveness of this is apparent.

The question now is, how can we best impress upon the Government that there is need for action? It is strange that a great political tremor goes over the land when the status and comfort of some thousands of Chinese miners are in the balance, and that an apathetic indifference is shewn to such a subject as this, which affects not only the comfort, but, as I sincerely believe, the very lives of a great mass of our fellow-countrymen. Permit me to hope that this Conference will not allow the matter to rest until a satisfactory solution has been found.*

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* For Resolution passed on this Paper see page 607, No. 10.

SANITATION, PAST AND PRESENT.

By THOS. J. CROFTS,

District Sanitary Inspector, Public Health Department, Bristol.

ABSTRACT.

ALTHOUGH sanitary progress and the advancement of public health have made great strides under existing Acts of Parliament, there still remains a great work to be performed by sanitary reformers; the housing of the working classes in our large towns is a problem to which a satisfactory solution is admittedly difficult; amendments are needed in the law relating to meat and food inspection, the inspection of meat will never be carried out as it should be until the law steps in and insists on the examination of all meat before it is sold for human consumption; local authorities should provide an accessible public slaughter-house, which would remove the difficulties in the way of inspection; all premises in which food for human consumption is manufactured should be registered with the local authority and regularly inspected; we should have greater power to deal promptly with all serious dangers to the public health.

It is unfortunate for the community that sanitary authorities in provincial towns are still without any definite power to compel those who are responsible for the execution of drainage works to give them notice before proceeding to execute work necessary for the abatement of nuisances; we also urgently require by-laws to regulate the construction of drains for existing buildings: the London County Council has power to draft by-laws for regulating the construction of drains in new and existing buildings, and to require notice and plans together with particulars of any proposed works.

By-laws of the above description are required throughout the country, which would raise the standard of sanitary work in our dwellings; we want by-laws which would secure uniformity of sanitary inspection throughout the kingdom. The important duties which sanitary inspectors are now called upon to discharge demand that only qualified persons should receive these appointments; there is no class of public officers

who require protection in the performance of their duties more than the sanitary inspectors; many appointments are held during the pleasure of the sanitary authority, and the insecurity of tenure of offices renders it difficult in many instances for inspectors to discharge their duties satisfactorily; all appointments should be permanent, and only be dismissed for misconduct or proved incompetency, with right to appeal to the Local Government Board. The public have learnt to appreciate and have grown into sympathy with the sanitary inspector, and he is regarded as the friend and adviser of the people amongst whom he moves.

We who are working day by day amongst the people have many opportunities of leading and educating public opinion; it is in this spirit that the sanitary inspector's duties should be undertaken.

THE STATUS OF A SANITARY INSPECTOR.

By J. A. SUTTON.
Inspector under Sale of Food and Drugs Act, Nottingham.
(ASSOCIATE.)

ABSTRACT.

THE author, after pointing out the vital importance of an adequate system of training to sanitary inspectors, urged that it should be imperative that all candidates for a certificate should have been articled or apprenticed to a trade or profession, preferably one connected with building construction. Offers might with advantage be made through a public health department to promising apprentices, that, providing they attend classes embracing hygiene, building construction, sanitary plumbing, etc., and should they succeed in obtaining the necessary certificates of proficiency, they should be admitted to practical tuition in the office of a public health department, where they would complete the training necessary prior to the examination of The Royal Sanitary Institute. By this means we should get men skilled in some particular calling closely associated with their future work. We should then hear less about inefficiency, and, moreover, there would not be the hundreds of applications for a position carrying with it the paltry salary such as we now often see.

A properly qualified inspector, such as mentioned, would not be inclined to offer himself at a salary of £1 per week, as a certificated man has been known to do. He would rather continue at his trade, even if he did not succeed in getting a post as sanitary inspector. What better qualification or testimony could one desire than that of a qualified plumber or a builder holding in addition the sanitary inspector's certificate? There are many who already possess the certificate, but who would hesitate before accepting an inspector's berth at less than £100 per year.

This paper was submitted solely with the hope that something might be done to raise the status of the sanitary inspector to a higher plane than obtains at present, and this could never be accomplished while it is possible for people without adequate training to compete for the few vacancies which occur in the public health service.

SOME AMENDMENTS TO THE PUBLIC HEALTH ACT, 1875, etc.

By CHARLES MACMAHON,
Chief Sanitary Inspector, Torquay.

ABSTRACT.

THE definition of "drain" and "sewer" in Section 4 is one around which the fiercest controversy has raged. In 1878 a case came under the writer's notice in which the simple interpretation, "Sewer into which the drainage of two or more buildings is conveyed." Being, however, premises "within the same curtilage," the local authority declined to clear the pipes in question, and called upon the owner of the two premises concerned to do so. He refused, and referred to the quoted section, and the justices decided in his favour. Since that time, locally, no cases have been dealt with by legal process, but by the persuasive methods explained in the paper submitted. Perhaps a more practical meaning might be suggested to the section "Drain," any drain used for the drain of one or more buildings which runs under buildings or through private lands or premises, to which the local authority has no right of entry, and which drain was laid for private profit.

Section 36 lacks a few words in addition to "sufficient as applied to water closets, viz., a proper water closet, with sufficient water supply laid on to the basin, and an approved means of ventilation thereof." Section 189 refers to officers of local authorities, including the Medical Officer of Health and the Inspector: and Section 191 sets forth that the Local Government Board shall have the same powers over them with regard to appointment, salary, tenure of office, viz., as it has in the case of a district Medical Officer of a Union. These latter are not re-appointed periodically, and therefore have security of tenure, and likewise in recent years' superannuation, it would appear that if the existing powers of the Board were exercised, little further legislation is necessary in the way of extending such powers over all public health officers, whether partly paid out of moneys voted by Parliament or not.

Another suggestion is the substitution of the compulsory words, "shall" or "must," instead of the permissive word "may," which so often appears; though it has been the writer's happy experience, after a generation of sanitary practice, that he has had only a dozen occasions for enforcing by legal process the powers conferred upon him.

CONGRESS AT BRISTOL.

CONFERENCE OF WOMEN ON HYGIENE.

ADDRESS

By MISS MARY CLIFFORD.

IT is a matter of sincere regret that Her Grace the Duchess of Beaufort is not able to be with us and to preside over this meeting to-day owing to a family bereavement.

The eight subjects which we are desired to consider to-day are all intimately connected with home life. This strong current of thought coincides with the recent advice of Mr. John Burns, "Concentrate on the mothers."

The opening note of our Congress on Monday evening was, the close union between health (national as well as individual) and morals; that is to say, between our material and spiritual life. Along that dusty road we recognise, shining through, an eternal aspect. We see, perhaps, in the frail baby the great and brilliant spirit waiting to be developed. We take courage, believing in the infinite value and endless possibilities of human life. We work on, knowing that the fresh air and wholesomeness we are striving to gain for our fellow-creatures tend to produce that joy in life and that clean mind which Nature, which is the expression of the mind of God, intended to be ours. Purity, order, self-control, health, and happiness are meant to be our portion. As Professor Lloyd Morgan said on Monday, "In solving the problems, keep near to Nature"; keep near, that is to say, to the intention of the Creator.

Light, air, water, and, I may add, *rest*, are free gifts, thoughts of a beneficent mind for our benefit. A striking example is to be seen in the new system of the bacterial treatment of sewage, where light is the chief agent in purification.

I should like to mention in connection with one of our subjects, "The Conditions of Health in Country Districts," how great the advantage of country life in respect of natural facilities for rest. Surely the rush of town life is a menace to mind as well as body, and especially the rush which makes no pause on Sunday. Railway and especially tramway companies have a grave responsibility in the strain to which some of these companies subject their employés, giving them practically almost no Sunday rest or its equivalent. This strain will certainly affect the brain power of the next generation.

All these things echo the opening thought of this Congress or illustrate Professor Lloyd Morgan's words that "we are part of a universe and not of a chaos." Our individual duty is to realize this truth and to make it a power.

As women, perhaps we need a word of warning here. We are naturally quick in our mental processes and find slow methods irksome. We *fly* to conclusions. Therefore we are somewhat apt to try what we hope to be immediate remedies. But short cuts in a new country are proverbially risky.

Making a thing illegal is not always a successful cure; neither does getting the State to undertake our difficult problems always solve them in the way we should desire. Both these expedients must be used with caution. Let us look well before we advocate remedies on these lines, and especially if a moral flaw in the process is observable, let us hesitate and consider where we are being led. It is not very difficult to get a bylaw or even an Act of Parliament, but it is of real use only if it builds up the soul of the nation as well as its body. Also, if we induce the State to undertake duties which you or I or someone else is ignoring, consider whether our energy or our conscience will not suffer, and our standard of conduct will not degenerate.

Specially do these dangers beset the important subjects we are now about to consider, and the supremely interesting one, home life, with which they are so closely connected. The moral, that is to say, the eternal, relation of sanitary science will always be the background to all our work.

SOME SUGGESTIONS AS TO THE BETTER FEEDING OF INFANTS.

By MISS EDITH M. EVANS,

(ASSOCIATE).

ABSTRACT.

THIS title covers a very large ground, and for convenience the subject may be divided into two sections; first, the points which directly affect the mother and child, and second, the points which come under the head of legislation and education direct or indirect.

The necessity for education cannot be too firmly insisted upon, the fallacy of imagining that knowledge comes with maternity cannot be too strongly fought against, and the idea that ignorance only belongs to the poorer classes on these matters must be dispelled. We have constant evidence that the children of well-to-do young mothers suffer from the results of ignorant feeding.

One cannot help feeling that medical men and consequently nurses would be a much stronger educational power in the world if their training in schools and hospitals included knowledge of the proper development by food, air, sleep and exercise of young life. Their knowledge of the pathological condition of children is often developed to the exclusion of knowledge of the maintenance of healthy condition, and we would, therefore, advocate with all deference to the powers that be that such knowledge should be inculcated during the training, both of specialists in the care of women and children and those who become general practitioners.

In considering the points affecting directly the interests of mother and child, we must first think of the mothers of the poorer class who suckle their children, and here for suggestive hints we must turn to our French neighbours and see whether their pioneer work in this matter is likely to be applicable to our English mothers.

Work in France.

M. Henri and Mme. Coullet were brought face to face with difficulties in helping poor nursing mothers, which ended in starting free restaurants for nursing mothers where they can obtain two good meals a day. No questions are asked of the applicant for food except whether she is nursing her child, and many mothers and children benefit daily by the food and sympathy they receive at the restaurants. At present one feels that there are many difficulties in the way of such a plan in England. We know that English people in that class do not customarily go out of their own houses to feed, that mothers of families should be encouraged to be with them at meal-times, that clean houses are rarely made except by homekeeping women, and that in England at the present time family life is in danger of being destroyed by the removal of responsibility from the parents. Is it not possible that this cry for free meals for nursing mothers gives the father one more opportunity to evade his responsibility?

The French have another organisation which calls for much consideration, namely, their "Society for Nursing Mothers," which is recognised by Government, and has been at work for thirty years. Its primary objects are the care of the poor mother before her child is born, and of both mother and child during the first year of the child's life. The branches of this society are many, and include shelters for destitute and homeless mothers before the birth of the child, maternity hospitals, relief bureaux and dispensaries; and there is a special arrangement by which voluntary workers (educated ladies) take certain mothers and children under their care. The children are kept under medical supervision until they are two years old.

There is much food for thought in this scheme for English people, adaptation of the possible side of it seeming to give much better prospect than the idea of offering free meals indiscriminately to nursing mothers.

Milk Depots.

Depots for the supply of pure or specially prepared milk for infants have been established both at home and abroad, and it is hoped will prove very useful in these cases, but there will have to be much patient instruction before the hope is fulfilled.

Complaints are constantly made that the bottles provided by the municipal authorities at their depots have been improperly used, that there is no doubt that the children have had food other than the

regulation milk administered from the bottles, as foreign matter such as tea, bread, biscuits, etc., have been found when the bottles have been returned.

EDUCATION.

It seems as if all efforts to improve the feeding of infants and young children bring us to one conclusion, we must teach, and again we must teach with all the patience and energy we possess.

Who are to be the teaching agents?

This is a big question, and it seems an important matter to many of us that we should make use of all existing agencies, though personally I would make one exception and that is, that I do not think the subject of infant feeding is suitable to include in elementary school teaching, apart from the fact that the syllabus is already over-crowded.

We are apt to forget in big movements that small societies, individuals in all ranks have been and are working for the same object, and that it is worse than foolish to ignore such work. We ought to ask, even to beg for combination or co-operation in this matter.

MIDWIVES.

The first person who appears to be a suitable agent for this work amongst the poorest women is the midwife (the woman who must now be on the register), who certainly has the earliest opportunity of putting the mother in the right way, whether she is able to nurse her child or not.

Objections will probably be offered to this suggestion on the ground that at present the standard of knowledge among these women is not sufficiently high, and that beyond their technical work they know nothing of children. This must be granted at once, but we know also that medical officers, and in some places the superintendents of midwives appointed under the Midwives Act, are doing their utmost in many parts to raise the standard amongst their local midwives by teaching them themselves, and that the teaching includes certain elementary knowledge of food values so that the women in time will be in a position to explain their reasons for insisting on certain food for certain ages, and then will also be anxious to rouse the conscience of mothers and make them anxious to rear a healthy child.

The gradual elimination of unsuitable women and the devolopment of the more capable by training must in time make this class of workers a real help in the dissemination of knowledge.

Health Visitors.

After the midwives come the health visitors now appointed in many large towns, though in too small numbers to grapple with this subject. Some, of course, can only deal with other matters relating to public health, treating this special work incidentally, and we anxiously await the appointment of qualified well-paid women in this department. In certain towns, health visitors are being employed in comparatively large numbers, but they are working for shorter hours, smaller salaries and with no special qualification for the work, and are supervised by unpaid educated ladies. The reports of the work appear satisfactory, but experience goes generally to prove that the better qualified women do the best work and are more readily accepted by the poor. There are many medical officers who will endorse this opinion, who have had sufficient experience to value the woman of education and refinement for such work. District nurses are excellent agents in this matter and their help ought to be solicited in every district in which they are at work, though they of course can only give their advice incidentally, as actual maternity cases do not generally form part of their routine work. It is hoped that such visitors may in time be attached to the out-patient department of children's and general hospitals. Another class of visitors who have many opportunities of giving advice and considerable power in enforcing it are the ladies on the boarding-out within and without union committees. District visitors attached to all Churches and Chapels, superintendents of mothers meetings should all be asked to add their testimony in favour of proper feeding and should be supplied with requisite literature for distribution.

Educational Literature.

We must also consider the best form in which this literature should appear. Many leaflets are in existence in different parts of England which are distributed amongst the poor relating to infant feeding; many bearing the impress of much thought and real knowledge, but the weakness of most of them seems to lie in their elaborate wording and complicated construction, which defeat the end in view by bewildering the poor and often illiterate mothers.

Legislation.

The important points with regard to direct legislation are those relating to notification. At present the law, which allows notification to

be legal if given in the course of six weeks, allows many children to die within that time for want of skilled advice.

A few Councils have authorised the payment of one shilling to be made on the notification of a birth within forty-eight hours, and if compulsory notification in that time, or even within a week, could be enforced and possibly rewarded, many lives might be saved.

Compulsory notification of still-birth would also, one cannot but think, have an influence on the birth-rate. We should hear less and less of so-called still-births if it were to the advantage of those concerned to notify the birth of living, healthy babies. It is also much to be desired that amendment should be made with regard to the Infant Life Protection Act, and that the period during which a woman may not go out to work before or after confinement may be very considerably lengthened.

Nothing has been said of the rewards offered by philanthropic people for healthy babies, reared on proper food, on the completion of their first year, or of the number of societies which exist for studying the conditions and the improvement of conditions of child-life. We must welcome heartily all these efforts as steps in the right direction, but there is at the same time great need for co-operation between municipal authorities, societies, voluntary workers; in fact, amongst all existing agencies who desire to encourage mothers to rear healthy citizens, with sound minds and sound bodies, instead of taking a pride in burying their babies at an early age.

SOME ASPECTS OF THE MIDWIVES ACT OF 1902.

By MISS EVA H. JONES.

(ASSOCIATE.)

ABSTRACT.

THE Midwives Act of 1902 has been the subject of much criticism; but the public as a whole have hardly realised either its usefulness or the immense possibilities it opens up to a well-organised local authority.

The poorer working classes of this country are rarely in a position to afford skilled medical attendance at child-birth, this being especially the case in the slums of our large cities, where so many of the inhabitants live habitually near the poverty line, and on the slightest accident fall below it.

A large proportion of wage earners are unskilled labourers, their weekly income averaging about 18s. When one remembers that in the winter this wage is subject to reductions, and that many families last season were subsisting on 8s. per week, it is not difficult to realise that the wives of such workers are unable to pay heavy fees for attendance at the time of confinement.

But recently in one of the poorest districts of Bradford, a woman was confined of twins, the husband, a hard working man, bearing an excellent character was out of work. On entering the home, I found the mother in a very exhausted condition, being on *water* gruel, and that not of a proper consistency. Such a circumstance is of no uncommon occurrence, yet the lives of poor women are as equally precious to their husbands and children as those of their wealthier sisters, and the Midwives Act of 1902 will prove an immense boon to them, ensuring skilled attendance in child-birth.

This Act prohibits any woman *not* certified under it from using the *title* of midwife, and arranges until April, 1905, for the certification of women already in practice.

After April, 1910, however, no woman may practise without the certificate of the Central Midwives Board.

The Central Midwives Board has been formed to arrange examina-

tions, and make regulations for the guidance of midwives and the local authority. And it becomes the duty of the local authority to enforce those rules, reporting any infringement of the same to the Central Midwives Board.

Many of the existing certified midwives are extremely ignorant, many being unable even to write. The local authority is, however, now authorised to supervise such women, and a superintendent is usually appointed to inspect the midwives in each district. That this superintendence was urgently required is proved by the conditions revealed.

The ignorance of the *present* midwives is a problem that all local authorities require to face. Some remedy is necessary; and besides appointing a superintendent to inspect and instruct them, it appears necessary that lectures by medical men should be given to them on general hygiene and infant feeding.

The problem of infant mortality is ever before us, and doubtless a staff of properly trained midwives might do much towards spreading knowledge on health subjects.

In Bradford alone there are 101 midwives, 71 being certified; these women come daily into touch with the poorer classes of the city, and were they to receive a course of lectures on the above subjects, the prevailing high rate of deaths among infants might be much more successfully combated.

District visitors and those societies taking an interest in the poor might obtain a list of qualified midwives from the superintendent, and advise those they visit as to the women they employ at their confinement.

In Bradford I recently adopted the plan of writing an article on infant mortality in the monthly magazine of the "City Guild of Help," supplying that society with a list of satisfactory women, for it is only by co-operation in matters affecting the public health that true progress will ever be attained.

THE CONDITIONS OF HEALTH IN COUNTRY DISTRICTS.

By MISS MABEL SHICKLE.

(MEMBER.)

ABSTRACT.

IT is doubtful if it is to the nation's interest to teach hygienic truths and the essential laws of health to children living in country districts, unless the home surroundings are such that they can realise these truths. Will it not rather tend to increase the influx of the rural population into the towns, to live in the improved workman's dwellings which are being built in so many urban districts?

Conditions essential to the laws of health are fresh air, good water, properly constructed houses, sufficient floor space, good food, suitable clothing, habits of cleanliness. There is a plentiful supply of fresh air outdoors, but inside the cottages the supply is very limited, arrangements for ventilation being often nil. Before compulsory education villagers were content to have only rafters in place of ceilings in the cottages, the walls were often not even plastered, thus allowing ventilation through walls and thatch, and the cottage door was always open. Now the ceilings are plastered, the walls plastered and papered, rendering them impervious, and frequently the cottage door is closed. This loss of ventilation has not been remedied. The windows do not open, and through ventilation is often impossible.

Water is a prime necessity of life; an abundant supply is an absolute necessity for the preservation of health. In many rural districts a safe and adequate supply of water is the most pressing need, much of the prosperity of the district depending largely on the health of the animals and the sale of milk. How often the rural district council decline to realise this until there is an outbreak of disease. With little expense a plentiful supply of surface water could be arranged for, even if the drinking water had to be obtained from a distance, thus enabling the cottager to obtain greater cleanliness in the home and person.

THE WORK OF WOMEN AS SANITARY INSPECTORS & HEALTH VISITORS.

By MISS K. L. LONG.
(ASSOCIATE.)

ABSTRACT.

TO the city of Nottingham belongs the distinction of being the first local authority to appoint a woman inspector of workshops: that appointment was made in May, 1892. Kensington was the pioneer in London, appointing two women as inspectors of workshops in October, 1892; while to Islington falls the honour of appointing the first woman with the status of sanitary inspector in April, 1895.

Until 1899 the certificate of The Sanitary Institute was the requisite guarantee of competency. In that year the Sanitary Inspectors Examination Board was founded by the Sanitary Institute in conjunction with other bodies, and candidates for posts in London must now hold the certificate of that Board. Some London boroughs and provincial towns give facilities for gaining practical experience to those who have obtained the necessary certificate by employing them either as voluntary workers or as paid probationers under the official women inspectors. Leeds, for example, gives an excellent training lasting six months, during which time the probationers are given an insight into every branch of the work undertaken by women.

The various duties laid upon women inspectors are as follows:—

I.—The inspection of laundries and workshops where women and girls are employed. The duties of the sanitary inspector in this connection are well defined. She is responsible for (*a*) the cleanliness and adequate ventilation (not temperature) of the workrooms; (*b*) the number who may be employed in each room; (*c*) the drainage of the floors of wash-houses in workshop laundries; (*d*) the provision of suitable, sufficient, and where both sexes are employed, separate sanitary accommodation. Defects in drainage involving structural work are usually reported to the Medical Officer of Health who hands them over to the male inspector for the district.

It is much to be regretted that the small laundries in which only members of the family and not more than two outside hands are employed should not come within the scope of the Factory Act. Large quantities of work are done in these small laundries, but by sending the heavy articles, such as sheets and tablecloths, to a steam laundry, where they are done at trade rates, and by working long hours, the laundress obviates the necessity of employing more than two women and thus escapes the restrictions of the law.

II.—An equally, if not more important branch of a woman inspector's work is that of visiting the homes of outworkers, a term applied to those who do certain classes of work in their own homes instead of on the premises of their employers. When we consider that a very great proportion of the wearing apparel offered for sale is made in the homes of the poor, frequently under dirty and insanitary conditions, the necessity for inspection must be recognised.

III.—The inspection of houses let in lodgings and of tenement houses in some few boroughs falls to the lot of the woman sanitary inspector. She is required to see that the necessary cleansing is carried out at stated times; in case of infectious disease that proper precautions are taken; that there is no overcrowding; and that the premises are kept in a thoroughly sanitary condition.

IV.—The carrying out of duties connected with the cases of notifiable infectious diseases is in some districts the work of the woman inspector; as also the visiting of schools where have occurred cases of measles and other non-notifiable childish complaints, in order that precautions may be taken to prevent their spreading; visiting the homes of the scholars and urging the mother to keep the children isolated. In cases of measles where no doctor is in attendance a word of advice as to the necessity for keeping the child warm sometimes prevents the unhappily too frequent consequence of bronchitis and pneumonia.

V.—In many boroughs a system of voluntary notification of consumption obtains. The ignorant belief in the non-infectious character of this disease is so deeply rooted among the poor that great tact is needed in visiting these cases. The necessity for sunlight and fresh air must be urged; advice given as to the advisability of the moist cleansing of rooms; and, most important of all, the infectious nature of the sputum must be pointed out, and the proper method of its disposal taught. Disinfection after the removal to hospital or death of the patient is always urged, but it is most difficult to persuade the poor that it is necessary.

VI.—The inspection of hotel and restaurant kitchens also finds a place among the duties of women sanitary inspectors in certain districts, as also that of public lavatories for women.

In some provincial towns the inspection of shops under the Shop Hours Acts, 1892–95, and the Seats for Shop Assistants Act, 1899, forms part of the woman inspector's work. In London it is carried out by officers of the London County Council.

VII.—In most boroughs all deaths from diarrhœa of infants under one year are investigated by the woman inspector. It is a most delicate matter to point out to the bereaved mother that in all probability the unwise method of feeding the child brought about its death, but it has to be done for the sake of those who may follow, and in many instances has been the means of insuring the proper feeding of the next baby.

The visiting of infants after the notification of birth is not recognised by the Local Government Board as the work of a sanitary inspector. Should such work be deputed to her, the salary for the proportion of time spent on it must be wholly paid by the local authority. In some of the London boroughs, and in many provincial towns, health visitors are appointed to carry out this most necessary work. The rate of infantile mortality is so appallingly high that any effort to check such needless waste of life must be looked upon as work of the highest importance.

SOME ASPECTS OF HEALTH IN THE FACTORY AND WORKSHOP.

By MISS EDITH L. MAYNARD.

Secretary, Industrial Law Committee; formerly Sanitary Inspector, Sheffield.
(ASSOCIATE).

THE subject of health in the factory and workshop is a wide one, and within the limited time at our disposal it is impossible to deal with it from every aspect.

Broadly speaking, in dealing with unsanitary conditions in factories and workshops, we deal either with general unhygienic surroundings, such as want of cleanliness, overcrowding, and defective ventilation; or else with specific unhealthy industries with their specific attendant evils.

I shall only attempt to touch on one or two points under each heading.

One of the most difficult sanitary conditions to ensure in a factory or workshop is that of good ventilation. It is easy to dismiss the subject with the statement that the workers do not like fresh air and will not have the windows open. Speaking from experience, I do not believe that the workers are nearly so antagonistic to fresh air as they used to be, or as they are supposed to be. The knowledge respecting the beneficial effect of fresh air and the evil effect of foul air has been of late and gradual growth even among the more educated classes, but the workers are now beginning to take their part in the general demand for more hygienic surroundings. What they object to, and what most people object to, is *cold* and *draught*. Even those of us who know what it is to be well clothed and well fed would distinctly object if we were expected to sit at some sedentary occupation during the cold weather with the window open close by us. We know well enough that the longer we sit at work the colder we are apt to become and the closer we draw up to the fire.

We need to bear in mind that the average factory or workshop worker is, in the first place, *badly clothed*. The factory girl, like girls in all stations of life, pays more attention to her dress from the point of view of ornament than from that of utility, and her underclothing is most scanty

and grievously inadequate for cold weather. The fact of being *poorly fed* further lowers her vitality and power of resistance to cold, so that she feels the open window much more keenly than would those who were well clothed and well fed. The open window as the only means of ventilation is, therefore, impracticable, and recourse must be had to some other means. In large factories mechanical means can be employed, but this is impossible for small workrooms, where the difficulty is greatest. A mica flap valve inserted in the chimney-flue to act as an outlet, and either a Sherringham valve in the wall or a piece of perforated zinc in place of one of the window-panes, to act as an inlet, will generally be found to greatly improve the air of a workroom. But the provision of these will not obviate the necessity of throwing the windows open wide in the dinner hour, although there are many workrooms where this is never done, either from forgetfulness or from the fact that meals are taken in the same room as that in which work is carried on.

Unfortunately underground workrooms are, particularly in some districts in London, on the increase. I think one may say at once that an underground workroom can never be a really healthy one. The absence of sunlight is, in itself, inimical to health, and further, the use of gaslight vitiates the atmosphere to a most serious extent, and even if electric light is used, its constant use cannot but be injurious to the eyesight. It is also most difficult, well-nigh impossible, to ventilate an underground workroom adequately, certainly impossible without considerable expenditure. In Mr. Tennant's Factory and Workshop Bill, now before the House, there is a section which stipulates, that no underground room shall be used as a workroom, unless it is certified by the District Council to be suitable for the purpose. It is to be hoped that this may become law.

One very common means whereby the air of workshops is contaminated is by the use of unventilated gas iron-heaters, particularly in tailors' workshops. I have inspected very many such workshops in which the air was indescribably offensive from the use of unventilated gas iron-heaters. It is strange in how few instances the occupier provides these heaters with a hood and flue to carry off the fumes, until instructed to do so by an inspector. We are all aware how phthisis is spread in dirty ill-ventilated workrooms; in addition to the spread of this specific infectious disease in such places, there are other serious evils which have to be considered. Not the least of these is loss of appetite. All those who are in touch with working girls know how foolishly they feed. They choose such articles of diet for their dinner as cheese and pickles, or jam tarts and strong tea. This is largely because they lose their appetites with working for long

hours in a vitiated atmosphere, and they need to tempt it with strongly flavoured food, frequently indigestible and wanting in sufficient nourishment.

It is difficult to consider the question of ventilation without considering also the heating of workrooms. Very many are the instances with which inspectors are constantly becoming acquainted of workrooms which are provided with no means of heating other than the gas jets. It is obvious that at the beginning of the day such rooms are bitterly cold, and by the middle of the day the atmosphere is contaminated to a most serious extent. There is at present no legal standard of purity for the air of workrooms, yet the law stipulates that although the temperature of a room must be reasonable, the means of heating shall not interfere with the purity of the atmosphere; the use of naked gas jets for such a purpose is therefore illegal.

In addition to the trades certified as dangerous, there are many others still uncertified, which have been reported upon by the Dangerous Trades Committee, and which hold admitted and sometimes considerable elements of danger. And, again, there are trades in which the danger, though not officially established, has been the subject of inquiry. There has been, for example, a Home Office inquiry into the tobacco trade, without, however, especial reference to married women, and there are many who consider that *the mother* is the person most susceptible to tobacco poisoning. Dr. Ballantyne, of Edinburgh, in his work on, "Ante-Natal Pathology," speaks so strongly of the danger of the employment of the pregnant woman in tobacco works, that his words cannot be ignored. He says, "There is no shadow of doubt that there is a very large infantile mortality in *post-natal* life among the offspring of women workers in tobacco," but that there is a difference of opinion regarding the effect of tobacco poisoning upon *ante-natal* life. Some are, however, convinced that abortion is very frequent among women workers in tobacco, and enquiries among the women workers of Nancy, in France, seem to bear this out.

I have made special reference to this trade, as it is possible that some of those present may have had experience of its effect upon women workers, and, in any case, further investigation into the rate of infantile mortality and of abortions among the workers in tobacco factories could not fail to be of great value, and I trust that the making of such investigation may not be postponed.

PHYSICAL DEVELOPMENT.

By MISS FERNANDA DAHL.

TO the women of the present day who take a prominent part in the struggle for existence, and particularly to those who enter the different professions in order to support themselves, the question of *physique*, the development of the body and its maintenance in good condition, are matters of great importance.

In consequence of the mental strain and continuous hurry in which we live, little or no time is devoted to keeping the body in fair working order. To insure physical well-being we must (1) realise the meaning of *Physique;* (2) understand the importance of *Development;* and (3) be conversant with the existing facilities for *Physical Training.*

1. By physique we mean that physical structure of which each component part should possess sufficient vital energy to perform its function well and easily. Every organ should do its work thoroughly and regularly, every muscle be of proper strength, and the brain and nerves equal to their fair share of work. This is only possible when the different parts of the body are developed in the correct ratio relatively to one another, and when the periods of exertion are counterbalanced by proportionate intervals of rest.

This result can only be attained in the case of a child which has a good chance from the beginning, i.e., is born of healthy parents and not handicapped by some defect inherited from either of them. Then, to keep up the standard of physique, the child must be well nourished and cared for, so that its body can grow and its brain develop under favourable circumstances. When it reaches the age of eight or nine years, a judicious amount of exercise, both out of doors and in, should be arranged, so that the muscles are educated at the same pace as the brain.

In youth plenty of exercise and sports are needed to counteract the evil effects of confinement during school hours, and in later life many women would find themselves far stronger and healthier if they still continued to take a certain amount of exercise such as that supplied in the gymnasium, or in riding, games, swimming, etc.

If physiology and anatomy were more frequently taught, girls would know better what a healthy well-grown body looks like, and would understand how well-being and happiness are endangered by disregard or tampering with Nature's laws. Their idea of beauty of figure would also

change, so that instead of admiring and imitating the figures represented by the modern fashion-plate, they would revert to the idea of beauty held by the ancient Greeks.

The first steps towards physical development of the poorer classes must be taken in the direction of improved air, food, and clothing, and then only after this is there any chance of making the body strong with the aid of a system of well-tried physical culture.

2. We will now endeavour to arrive at a closer appreciation of the meaning of *development*, which is synonymous with growth such as that of a plant or flower.

In plants we find cells and fibres similar to those in the human body, and these are influenced by the same physical conditions. If a plant is shut up in a dark, ill-ventilated room, and deprived of its proper nourishment, its condition would be the same as that of a human body similarly treated. Sufficient oxygen, sufficient light and food, are necessary to produce growth and life, and exercise and movement in addition are required for the development of muscle-fibre. Let me take, for example, a limb bandaged up, and kept perfectly quiet for three weeks or a month. Look at the result! Wasted, limp muscles, without tone and vigour, unable to perform their work. Compare them to the muscles in a labourer's arm. Look at these standing out in great bulk and strength and you will see what work and exercise can do to make muscle-fibre attain perfection!

Now, how can we (I am talking of women of the upper classes), with our limited time, give the body a chance of developing or growing in strength. Many of us have not the leisure for cricket, hockey, or tennis, nor can we afford riding on horseback, which are ways of combining healthy exercise with fresh air, we must therefore look to the gymnasium, which, although I regret to say it must be covered in, gives a good all-round education to our body if we are careful to choose the right kind of system of training.

The gymnastic lesson to be of any good, should be taken every day for about three-quarters of an hour to one hour, and the system which I recommend is the Swedish, which is admirably thought out and tested by its founder, P. H. Ling.

His idea is to educate the body so harmoniously that one part of it is not developed more than another. One very important part of his system is the *graduated tables* by which the pupil quite unconsciously goes on from very simple exercises to more and more difficult ones. This is a feature of the Swedish system as yet very imperfectly known or understood in this country, and one which makes the system quite distinct from and superior

to any other. The student has to learn to make these graduated tables and to practise them during her college life, so as to be quite conversant with the method and able to carry it out later on. The pupil practises one table for a week, and then the exercises are made a little stronger for practice during the next week, and so on until she has acquired strength and agility. This result can only be attained when the pupil begins her training with the under-lying easy movements. On account of this careful graduation of exercises people of *every* age can with perfect safety avail themselves of the Swedish system of gymnastics.

You may be interested to hear how the gymnasiums are conducted in the country where this system originated. The hall used is large and airy, perfectly ventilated, and spotlessly clean, the floor being wiped over with a damp cloth between every lesson and the next. The children, who are dressed in suitable clothes, are taught by well-trained teachers for three-quarters of an hour to one hour every day. This lesson is compulsory, and time made for it although the education given is on a very high level. In some of the large gymnasiums shower-baths are provided all round the hall, which the pupils can use after the lesson.

Let us now consider the difficulties which beset this kind of physical development in England, and let us look at the conditions which prevail in the higher class of schools, those of which I have most experience: The available rooms are often unsuitable, being used for many purposes, badly ventilated and dusty. No time is allowed for sweeping the room before the lesson, or what is almost worse, a hurried attempt is made just before the class begins, so that the children take their places in a cloud of dust. Half an hour to an hour a week is considered ample time in which to develop and strengthen the physique of the school-girl. If one tries to urge the necessity of daily exercise the same answer is always given, "it is too much exercise," or, "we could not possibly get it in with all the other subjects to be taught"; and one may well ask how is it that in other countries where education is far better than in England time can always be found for developing the body as well as the brain.

Another hindrance to the teaching of gymnastics is the unsuitable clothes worn by the children and girls. A few years ago it was quite usual for pupils to come to their lesson with high-heeled shoes and wearing stays, and although one is glad to have been able to take a stand against this, yet the custom has not altogether disappeared. Girls and women still display a considerable amount of astonishment at being told that they cannot come to the gymnasium without a suitable costume.

The habit of practising in the gymnasium having been allowed to drop it is seldom that a girl takes it up again when her school days are over, it

has been left behind with the doings of childhood, and I can say for certain that not 10 per cent. of girls care to think about keeping up the strength of the body.

Lately I have been glad to notice a tendency on the part of older girls and even married women to join classes for physical training. In this connection I should like to give a word of warning. Women who have not had any previous training should be very careful not to over-do themselves at the beginning. They can safely entrust themselves to the graduated course of the Swedish system; but suddenly to undertake the violent exercise supplied by some systems is dangerous.

At the beginning of this paper I mentioned that exertion both physical and mental must be counterbalanced by corresponding periods of rest. People often lose sight of the fact that rest is as necessary to the development of the body as exercise. Muscles waste, and nervous energy is given out during work, and it is only in the interval of subsequent rest that they are renewed. Through ignorance of this law of the rhythm of work and rest, and often through carelessness, and even wilfulness, those forces of the body which if properly used and fortified would last for a life time are recklessly squandered. Then weeks and months of inaction have to be given to pay off the debt incurred by the daily theft of short intervals of rest which nature demands in which to restore the energy given out by the body in work. To the professional woman an hour's rest either before lunch or before dinner would be of untold value. We should hear less of over-work and break-down if this were universally recognised. By rest, I mean a period of relaxation of mind and body in a room by yourself, if dark so much the better, and undisturbed by friendly or business talk. The renewed power of the body would amply repay the time taken from business, and would save that sad waste of time and energy occasioned by the nervous break-down when nature asserts herself and demands her due.

Slowly, very slowly are the English people beginning to realise the fact that to produce a healthy nation men and women must be strong and physically sound. A great out-cry has been raised about the physical deterioration in the country. It will only be by means of the combined efforts of earnest men and women, trying to raise both the moral and physical standards that we can hope for improvement in the future. It will be slow work and hard, but when once the root of the evil is recognised, remedies will also be found. One of these will be the recognition by women of the important part they play in the improvement of the physique of the coming generation, which imposes upon them the duty of keeping their own bodies in good health.

CONGRESS AT BRISTOL.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

ADDRESS

BY

The Rt. Rev. The LORD BISHOP OF HEREFORD,

PRESIDENT OF THE CONFERENCE.

THE President, in addressing the meeting, said that he had not prepared an address for printing. The Conference was for younger and more scientific people. He belonged, as a teacher and schoolmaster, to the pre-scientific age: a survival who could only listen to the younger students, and whose reminiscences might be of some interest. Close on forty-four years ago he began his work as the first headmaster of Clifton College, began it without any training or instruction in sanitary matters either inside school or out of it. And in his reminiscences and criticisms he was thinking mainly of boarding-school life in our secondary schools.

Clifton College, at that time, was little more than a green field, but he had one advantage (mentioned because he saw the prominent part women were taking in this Congress), that was that he had a wife with a natural genius for the management and care of boys and a mother's heart and sympathy with them.

A boarding-school should be made in all respects as like as possible to a good home. The more attention we give to details the more we should keep in mind the ideal.

He remembered his excellent and experienced housekeeper coming into collision with the architect of the school house. "Well," she said, "if you had only been a woman for one five minutes you could not have made such mistakes."

The subjects of our consideration here are the very commonest things of daily life, air and light, and the tests that determine character and self-control.

We had not realised in those early days at Clifton what a large amount of cubic space was needful. If intellectual work is to be done it must be done in good air.

The question of clothing was of importance. We are not yet certain that all the important questions of clothing have been settled. Boys need to be protected from silly and foolish fashions in the matter of clothing.

After several years' interval he became the headmaster of Rugby, and found that change is not always progress. "I admire athletics, I detest athleticism." Professional athleticism had been the cause of a change; every boy thought it necessary to clothe himself in flannels cut off about the middle of the thighs. Many of the little boys were absolutely in danger of permanent injury to health owing to the obligation to wear the fashionable garment. The Headmaster made war on the custom, and insisted that flannels must be worn to reach the stockings. He succeeded in this conservative reform, although it is not always easy for a conservative reformer to stop tides of fashion.

The question of food in school must not be passed over. The tuck shop should have attention, and it should be an invariable rule that ready money be insisted on. Hampers have to be regulated in the strictest way. For growing boys it is of the utmost importance that before they are turned out in the morning to work, they should have some food.

There is a necessity, too, for some choice and variety in the meats for dinner, and a moral as well as a physical requirement for suppers to be light, with wholesome drinks. Alcohol is always bad. Bread, cheese, and beer used to be supper, and a thoroughly bad supper. Dr. Percival still feels thankful that, if he did nothing else that was good at Rugby, he was able to abolish this sort of supper.

Sleep has lately, and rightly, been increased through its value being appreciated.

Boys must be kept employed, must be busy. The loafer is the most dangerous element of any young society. A healthy boy has a natural and wholesome interest in games and play. There is, however, still in school a great deal of dull and uninteresting work, and the first thing a teacher has to strive for is to make both work and life interesting.

INSTRUCTION IN HYGIENE IN TRAINING COLLEGES.

By MISS ALICE RAVENHILL.

(FELLOW.)

ABSTRACT.

WITH the desire to promote a fruitful discussion upon instruction in hygiene in Training Colleges, it seemed to me most important, in the first place, to present so far as possible an accurate statement of the existing position assigned to the subject in these institutions, as, without such information, suggestions might be advanced which have been already tested and found unfeasible, or schemes might be advocated for the realisation of which no facilities exist. To this end I addressed a series of questions or, more accurately, of statements, to the principals of sixty-five Training Colleges for teachers in elementary schools, and to fifteen University professors or heads of colleges concerned with courses of training for teachers in secondary schools, purposely framed in very general terms, dealing with somewhat contentious points, in order to elicit frank opinions and free criticisms; an end most satisfactorily attained. Courteous, valuable, and in many cases very full, replies reached me from thirty-three of the former and eight of the latter class of college; for which I desire to express my thanks, as well as my cordial appreciation of the time and trouble expended by my correspondents, and of the encouragement afforded me by the patience they exhibited with my somewhat crude enquiries. The genuine interest shown in their object is most satisfactory.

The eight answers which refer to courses of study in preparation for University Diplomas in Education point out, with one exception, that the limitations of a period of professional training confined to one year prevent any extended study of the subject of hygiene. It is stated as only possible to give from four to twenty theoretical lectures, with occasional demonstrations, on sections of the subject. The prevalent feeling seems to be that none but science graduates could attack the study from the biological side, and that any general knowledge of hygiene is unnecessary for the ordinary teacher. From this I dissent, but am disposed to agree

with the views of the one exception above referred to, whose experience is remarkably wide, and who considers that some part of the four years' work in girls' secondary schools might with advantage include a course in Domestic Science, designed to afford a training in applied science, which would give to all women at least a basis of practical hygienic knowledge upon which they could subsequently build according to the life-work they adopt. The University of Liverpool Department of Education offers courses,* however, admirably designed to afford teachers an ideal groundwork for their professional studies. It remains to be seen to what extent they will be selected by students.

I propose, however, to offer a brief *résumé* of, and to deal chiefly with, the material collected from thirty-three of our most representative Training Colleges for elementary teachers, in which, it must be remembered, the curriculum is necessarily framed to enable students to pass the Board of Education examination. Far too large a proportion of the two years' course is at present spent on the acquirement of subject-matter, instead of being devoted to a study of child nature and of methods of teaching adapted to its varying needs and phases of development. This false proportion in the expenditure of valuable time is stated on the best authority to be inevitable, until students enter college more adequately equipped in general knowledge.

With one exception all the Training Colleges reported that some attention *is* given to hygiene during this training period; but owing to the pressure of other studies it is usually ranked as of secondary importance. Nineteen colleges definitely stated that owing to the overcrowded state of the curriculum it is impossible to set apart much, if any, time for its study. Three, however (in each case women's colleges), confirm, by the syllabuses and time-tables they enclose, their assertion that it is feasible to treat the subject as of primary importance; these also emphasising its undoubted value as a useful means for co-ordinating other

* Diploma Course H.—Professor Sherrington, Professor Harvey Gibson.—PRINCIPLES OF GENERAL PHYSIOLOGY. Autumn Term, hour to be arranged. Vital functions; division of labour and specialisation of structure in the organism; nutrition, respiration, and exertion; diet and activity; temperature and heat-production, *e.g.*, in man; sensitivity and sense-organs, *e.g.*, of the child; protoplasmic movement, locomotion—active and passive; adaptation of life to its environment; variation, heredity, struggle for existence, and natural selection; cycle of life in the economy of nature.

Diploma Course J.—SCHOOL HYGIENE. Summer Term, Monday and Wednesday, 11.30—12.30. The course deals with: Bodily health; nutrition; food and dietary; the care of the teeth; respiration; ventilation; body-temperature, warming of rooms; clothing; the skin; chills and colds. The sense-organs and the nervous system; the eye, reading and writing; the lighting of rooms; the ear; the voice and throat; the muscular system, physical exercise; fatigue in the class-room and play-ground; growth and its periods. School-buildings and sanitation.

studies. Three more affirm that, could the necessary time be found, direct attention to the subject, or the acquirement of mere knowledge of the theory of hygiene, is of far less moment than training in habitual practice, and must not be confounded therewith. Thus the majority agree that insufficient attention is paid to hygiene at present; but to give more is impossible until the Board of Education reduces the grievous burden imposed upon these young students. The already overcrowded curriculum and the demands of the severe examinations required to gain the certificate granted by the central authority constitute a serious tax on immature powers.

My second inquiry referred to the method by which such hygiene as is included in these courses is studied. It appears that the subject is usually acquired in the form of disconnected fragments, no co-ordinating course existing to unite these into one whole. Some knowledge of the theory of personal hygiene, for instance, is gained in the courses on "Voice Production" or "Physical Training"; Child Hygiene is treated chiefly under "The Principles and Practice of Teaching," while a brief course on School Sanitation is always included; practical applications to human needs being also often made in the Nature Study course. With rare exceptions students are not introduced to the broad general principles upon which these various applications are based; neither is a foundation of elementary anatomy and physiology considered an essential preliminary. Sixteen colleges assent generally to this statement; in three more time is made to present the subject as a connected whole; while one finds the Board of Education Course in Hygiene useful for co-ordinating purposes. Others seem of opinion that the more or less fragmentary teaching serves to emphasise the wide scope of the subject, which thus presents itself under so many different heads; while, again, the superiority of practice to precept is urged in favour of trusting to indirect rather than to direct and continuous teaching. With all respect for the authorities who support this method of indirect training in hygiene, it is only right to point out that, in all other subjects, rule of thumb methods are giving place to those of a more scientific character. Though this indirect method is, in my opinion, to be strongly advocated throughout the early years of school life, it presupposes a teacher well grounded in the reasons for his example and practice. These can only be fully acquired by the ordinary means, that is by an intelligent study of theory, supplemented by experiment and practice; a method unnecessary and undesirable for children, but emphatically important for a teacher, who must be ready with his answers to endless questions, who must be able to point out the

folly of fads, and who should be sufficiently enthusiastic and scientific to revise his basis of hygienic theory periodically in the light of modern knowledge.

The third point raised in my questions was the method employed where "General Hygiene" as such is studied, whether it was treated as a purely theoretical subject, or intelligently and constantly co-ordinated with nature study and elementary science, and further vivified by practical applications made in schools and elsewhere. The majority replied that the first method is that usually employed, one says because no convenience exists for laboratory work. Seven out of the thirty-three speak of the employment in their colleges of the latter method; and one or two send interesting particulars of the way in which the General Elementary Science Courses are designed to promote this practical method. Three refer to the opportunities offered in women's colleges by the new optional subject "Housecraft," but agree that it will be rarely selected, on account of the choice of professional and other subjects more likely to appeal to teachers, and of the prohibitive amount of time and practical work which is required to qualify in it.

Equal diversity of opinion evidently exists as to the amount of interest taken by the students themselves in the subject of hygiene. Six principals only reply that real evidence of interest exists; and it is in three of those colleges that prominence is given not only to hygiene, but to the foundation studies of physics, chemistry, and biology, upon which it is based. In ten cases the want of interest is justified by renewed reference to the conditions of over-pressure, which make any attention to other obligatory subjects impossible, and give no leisure for thought or energy for a subject, which depends primarily for its interest upon personal observations and practical applications.

The following suggestions concluded the circular of enquiry, and though their conciseness rendered them liable to be misunderstood by those who viewed the subject from other standpoints, they served a useful purpose, for, without exception, comments and criticism of much service were made.

"In view (*a*) of the growing recognition of health as an essential means to individual efficiency and national prosperity, and (*b*) of the major importance of training young people to meet the problem of living with intelligence and success, the study of hygiene in Training Colleges should, *so far as is possible*,

(i.) be accorded a more prominent place in the curriculum.

(ii.) be based upon a preliminary *elementary* knowledge of anatomy and physiology, acquired by other than purely theoretical methods.

(iii.) That the course in elementary physiology should be supplemented by a *brief* comparative study of child anatomy and physiology, to be closely connected with nature study or the elements of biology. The whole to precede or coincide with the study of child psychology.

(iv.) That some acquaintance with the broad outlines of general hygiene should precede the more detailed study of school sanitation. This could be acquired without making increased demands on time if judicious applications to the methods, habits, and requirements of daily life were made during laboratory practice in physics, chemistry, and mechanics. The study of physiography, history, and geography could also contribute to this end, if the influence of environment, customs, economic conditions, and other factors were traced, as they affect human life on its biological side.

(v.) That a brief co-ordinating course would be of great value during the final weeks of a student's training, in order to indicate the personal, educational and sociological importance of a right conduct of life."

With respect to the comprehensive scheme thus outlined, the principal of one college would like a somewhat similar one to be available for a few selected students in every training college, in order that by degrees there should be at least one expert in hygiene in each school.

Ten condemn the suggestions as too elaborate, framed for specialists and unsuited to general needs. On the other hand eleven express themselves as in substantial agreement with the proposals, with, of course, the necessary qualifications, that due regard must be had to the claims of other subjects, that the elementary study of anatomy and physiology must be governed by the amount of time at the student's disposal, and that, unfortunately, some of the subjects here co-ordinated with hygiene are not included in many courses of study. But with one consent these eleven deplore the absence of the time necessary for the adoption of any such scheme, owing to the fourteen or fifteen other subjects which *must* be taken. Four out of the number invite suggestions for a less exhaustive course, and one other correspondent considers that each college ought to have a well thought out syllabus in hygiene along these lines included in its scheme of work. Three heads of colleges express their conviction that there is no need for hygiene as such to be taught at all; indirect methods meet every requirement. Two more advocate affording opportunities for such study either before or after the Training College course. They propose that these should be offered during the pupil teacher stage (as is now being done under the direction of Dr. Brown Ritchie at Manchester), or could be provided for certificated teachers when engaged in school work, by means of classes which include both theory and practice, such as those carried on so successfully for

some years past in the West Riding of Yorkshire, Staffordshire, Sussex and elsewhere. Three well known principals of men's colleges write in favour of short, special, co-ordinating courses, indicating the many threads of which the web of hygiene is woven. These, it is thought, could be given to all second year students in every training college, by an expert lecturer, appointed (as one suggests) by the Board of Education. He further advises that a course of twelve such lectures should be compressed into a week or ten days, in order to concentrate attention entirely on the subject, and so to arouse the enthusiasm necessary to stimulate an active response to the representations made. The real intention of the suggestions is recognised by an expert in education, who occupies the post of principal of an important Day Training College, and who writes: "The general criticism will be that the scheme seeks to make hygiene the *core* of instruction in schools"; which is just the fact!

One college (Edge Hill Training College, Liverpool) provides a first rate scheme for co-ordinating hygienic principles with the whole course of study, which is reproduced by kind permission.

Miss Hale writes—

"Briefly this is *our* method of procedure:—

(1). The students have an introductory address on the importance of health and attention to personal hygiene; certain practical rules being laid down which they are expected to keep.

(2). During their first term a course is given on Elementary Anatomy and Physiology, so that they may take their Physical Exercises (Swedish) intelligently, as well as see the reason for the rules of health they must observe.

(3.) The two years' course of Elementary Science makes them acquainted with the elementary facts of Biology,* Physics and Chemistry, so that the phenomena of ventilation, respiration, energy, composition and decomposition, etc., are practically considered. These lessons mean four hours' weekly laboratory work, and the bearing of the experimental or observational work on human life and development is borne in mind.

(4.) The course in the Theory and Practice of Education includes consideration (accompanied by observation) of the static conditions of the school and the home (*i.e.* the proper rearing of children), School conditions (dynamic), air, light, warmth, children at work, etc., physical endurance and fatigue, detection of abnormalities, ailments, etc., etc., that is, *a special hygienic section* in which the subject of the physical well-being of children is dealt with in all aspects.

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*"NATURE STUDY.—Animal Life. A study of the external characters, habits, mode of life, the chief features of the anatomy and the adaptation of structures to environment of the following animals:—1. Amœba, Hydra, Sea Anemone, Earth Worm; 2. Crab, Barnacle, Butterfly, Mussel; 3. Fish, Frog, Pigeon, Rabbit. The life-history of the above to be studied from direct observation as far as possible."

(5.) Coinciding with this, and generally treated of in the second year, is a course of Elementary Psycho-physiology, with a study of the nervous system, brain functions, etc., leading on to the final cousre, which is mainly *Ethical*.

(6.) The students are required also to write and discuss papers on such subjects as—

(*a*) The teaching of hygiene and temperance in the elementary school.

(*b*) The problem of the underfed scholar.

(*c*) School games.

(*d*) The class teacher's opportunities for the physical training of her pupils.

(7.) Short series of lessons (criticism and specimen lessons) are arranged and given by students to classes of children on the subject of hygiene or domestic science.

Systematic teaching has a tendency to become stereotyped or to lead to "water-tight compartment" teaching. It seems to me that the co-relational method is better. Hygiene should be shown to be related to all subjects of the curriculum, inasmuch as by using these as instruments of education both mind and body are being exercised, and the conditions of such exercise are as important as the exercise itself, if not more so."

It is true that the expressions of opinion just summarized represent not more than 50 per cent. of the total number of those to whom I applied for assistance; nevertheless they are sufficiently varied to be taken as representative, yet enough in accord to permit of classification. It may be fairly assumed that in a small number of training colleges (say 6 per cent.) students are given a scientific and suggestive basis for the right conduct of their own lives, as well as for their guidance in their educational work. In approximately the same proportion general hygiene is entirely unconsidered, and little but indirect teaching given on the special sections which must be taken to qualify for examination purposes. Among 40 per cent. there is a strong feeling that more attention ought to be devoted to the general, as well as to the special, treatment of the subject; evidence existing of a genuine desire to welcome suggestions, or, where at all possible, to adopt broader, more comprehensive methods of instruction. Almost as large a proportion, on the contrary, distrust the hint of any additional straw being added to the overwhelming burden laid upon the shoulders of those for whose efficiency as teachers they assume responsibility. These correspondents either fail to appreciate any educational value in hygiene as a subject, or consider that up till now the study of theory has resulted in such remarkably little practice that its omission is to be preferred to its inclusion in their curricula; indeed, some state

that in any case the laws of health can be adequately acquired by attendance at popular lectures. The so-called simple laws of health, or, more accurately, the knowledge necessary to the right conduct of life under existing more or less artificial conditions, are not, as a fact, particularly simple, neither are they easy of practice where a hundred unsuspected difficulties reveal themselves, or as many deep-seated prejudices have to be uprooted. A merely popular presentation does not suffice to equip a teacher of the subject, neither is it fair to him or to his work to delay his introduction to it until he has realised his ignorance by bitter failure and vexatious errors of judgment. Teachers whose eyes are opened after years of work to all the subject includes regret most deeply, not only their own loss, but that of those over whom they exercise so much influence.

A strong feeling is plainly present among heads of Training Colleges that until the Board of Education readjusts its examination syllabus, and until it is provided that the two years of Training College life shall be entirely devoted to the special preparation necessary for a teacher's career, to discuss the introduction of another subject, no matter how urgent, is futile; distinctly ironical even in the case of hygiene. The hopeless tone which characterises several most interesting letters, while painful, should serve as a spur to quicken progress in the right direction.

It is surely time that the teaching profession be equipped so to cultivate minds and to develop bodies that the static fatalism of the past be replaced in the near future by more dynamic, progressive views of life's possibilities, which cannot be realised until the community is permeated by a better understanding of cause and effect in relation to healthful growth and adult efficiency. For man is himself the greatest moulding and controlling factor in the scheme of nature, and is now chiefly "destroyed for lack of knowledge," or of energy to apply it, not, as in former times, by force of circumstances beyond his power to control.

DR. H. MEREDITH RICHARDS (Croydon) suggested the importance of seeing the problem in its true perspective. Did they want to make teachers into hygienic experts, or simply to make them sufficiently informed to carry out the instructions of experts with intelligence, and to exercise the sort of care and oversight that an intelligent and solicitous mother of the educated classes exercises in her own family? Miss Ravenhill apparently wished to evolve an army of experts, which was impossible. Many teachers had no aptitude for scientific work, and even the full course which Miss Ravenhill recommended would be

insufficient for the purpose, as a full course in medicine would have to be superadded to the preliminary scientific teaching. The introduction of self-sufficient, half-trained "experts" into elementary schools was to be dreaded. It was unnecessary for teachers to be familiar with the mechanism of errors in refraction or with the pathological results that may ensue. For practical purposes it was enough to impress teachers with the fact that children who cannot read certain test types, or who exhibit obvious signs of eye-trouble, should be examined by an ophthalmic surgeon. But he was in accord with Miss Ravenhill's recommendations, and had been enabled to arrange for a series of such courses in Croydon.

DR. S. G. MOORE (Huddersfield) said an examination of the subject by the Board of Education was required, with a view to balancing two points of view as to the teaching of hygiene, so that, on the one hand, the science of the subject might be used as a sort of educational dumb-bell, and on the other, practical effort might be made to teach hygiene to the teachers in such a manner that an immediate effect would be likely to be produced in the death rates.

PROFESSOR BOSTOCK HILL (Birmingham) said he had no doubt that a preliminary course of physiology was very desirable. This should only be of an elementary type, enough, in fact, to enable teachers to understand the principles on which healthy living depends. This should be followed by teaching of general hygiene adapted to school life. Teaching hygiene to teachers is quite another thing to teaching hygiene to elementary scholars. The former should be scientific, the latter elementary. Miss Ravenhill had been criticised as being too ideal, but it was desirable to strive for something above what appeared to be immediately attainable. Her proposals, *inter alia*, appeared to suggest the establishment of a specialised class of teachers, but a knowledge of hygiene among all teachers was desirable, and this would best be accomplished by the Board of Education so altering the curriculum of our training colleges as to make physiology and hygiene a part of the normal work of the student.

MISS THEODORA JOHNSON (Clifton) advocated the training of teachers in the subject under discussion as early as possible, an experience of some twenty years having shown the great need of such knowledge. Many of the social problems before the Congress would not exist if that knowledge were common. Women fail signally in their own special department, the home, owing to ignorance. Such questions as infant mortality, overcrowding, improper feeding, etc., prove it.

THE NEEDFUL APPOINTMENT OF MORE WOMEN INSPECTORS

FOR INFANTS' AND GIRLS' SCHOOLS UNDER THE COUNCIL OF EDUCATION.

By MISS ALICE WADMORE.

(ASSOCIATE.)

THE total number of children in elementary schools is 6,000,000; of these 4,000,000 are girls and infants (600,000). The number of men inspectors is 300 and that of women is 10. (Whitaker's Almanac, 1905.)

Miss Laurence is chief woman inspector for elementary and secondary schools, but with only a staff of ten women she is weak handed.

Surely women are more fitted than men for dealing with the questions that concern infants, girls, and women teachers? What is really required is that the 4,000,000 infants and girls should be inspected by experienced women, who are competent to judge of the school life of children and teachers, and who, as a matter of course, hold the certificates from The Royal Sanitary Institute, as health inspectors and for practical school hygiene.

This scarcely seems a line of work for the very young men inspectors from twenty-one to twenty-five, who have done well at Oxford and Cambridge, spent a year in a training college, and who know nothing of infants, girls, teachers, or practical daily and school hygiene. Under an experienced man inspector they are set to inspect schools, where the heads have been from one to twenty years.

How many men inspectors, working under the Council of Education, hold the certificates as a health inspector and for practical school hygiene? Probably not one.

How then can a very young inspector know about the health of infants, girls, and women? His knowledge must be most limited.

At the conference on school life, held in February, 1905, a resolution

was passed, "That His Majesty's inspectors of schools should be qualified in hygiene and sanitation, and familiar with the development of child life. This meeting therefore urges the Council of The Royal Sanitary Institute to memorialise the Board of Education to protect health in school life by appointing, at least, some men and women inspectors who are specialists in school hygiene." Miss Bathurst (late inspector under the Council of Education), in her article on "The Physique of Girls," in the *Nineteenth Century* for May last, says, "until women inspectors are appointed, in number bearing more proportion to the men, it will be impossible for questions which vitally affect girls to receive proper attention. A tradition survives among men inspectors that their duties are limited to obtain a certain fixed minimum of results, and the health of the child is looked upon as an accessory or even no part of their work. This is a great mistake."

Could not the Institute be invited to send up a strong resolution for the appointment of more women inspectors under the Council of Education, women who are experienced in school life and hold the certificates granted by the Institute?

THE IMPORTANCE OF THE EARLY TREATMENT OF AFFECTIONS OF THE THROAT, NOSE AND EAR IN CHILDREN.

By BARCLAY J. BARON, M.B.Edin.

Consulting Physician to the Throat and Nose Department of the Bristol General Hospital.

THIS subject has been greatly discussed during the past few years. Whilst, therefore, I cannot hope to say anything new about it, I feel that, in spite of what has been written and said, there is a surprising amount of child suffering due to neglect, on the part of parents and guardians, in observing what, to the trained eye, is so obvious.

Amongst the children of the well-to-do classes we find a certain amount of this, but amongst the children of the poor the suffering is truly lamentable.

The unfortunate neglect of timely treatment of affections of the throat, nose and ear may be to render them irremediable. Deformities of all the organs concerned become permanent, other organs connected with them become involved and the development of the child, mental and physical, is stunted and checked. It is impossible then, to educate or instruct such a child so as to fit him or her for the business of life.

Defective nasal breathing and its effects are widely seen and are most disastrous. This as is well known depends on mischief within the nose or behind it in the naso-pharynx and, so far as the evils due to defective respiration through the nose are concerned, it matters not whether a child has deformed or narrowed nostrils and no adenoid growth, or patent well built nostrils and a mass of overgrown tonsillar tissue in the naso-pharynx (adenoids). The blockage exerts evil effects regardless of the cause. My own experience leads me to say that quite commonly adenoids and intra-nasal trouble are found in the same case. The latter usually consists of hypertrophy of the turbinated bodies, but also, though not so commonly, of spurs on and deflections of the nasal septum. The effect of constant

mouth-breathing that strikes one, as one walks our streets, is facial deformity. The narrow jaw, protruding and irregular teeth, dry lips, pinched nostrils and the appearance of unrest, listlessness and even stupidity presents a sad picture of neglect. If we examine the mouth we find deformed jaws, teeth decayed, and usually ill-fitted for perfect mastication; dry, cracked, furred tongue and foul breath. The nostrils are narrow and small, and usually crusts and tenacious muco-pus greatly decrease the breath room through them.

Frequently there is deafness, with or without a discharge from the ear. The pharynx is dry, the palate paretic, mucus constantly trickles from the naso-pharynx and hangs about the pharyngeal wall and the uvula, which is often elongated, and the faucial tonsils are enlarged and diseased. Granular pharyngitis and a dry, atrophied, laryngeal mucous-membrane, with hoarse thick voice and a tickling cough, with hawking and spitting, are present. These symptoms are often associated with faulty chest development, and deafness and dulness of mind (aprosexia). Physically and mentally, such a child is far below a normal average standard, and to try and teach such a child efficiently is to court failure. In our elementary schools on which, as some think, so much money is being spent with such small results, there is a large number of these cases, as medical and lay inspectors know well. It is not too much to say that until this picture of crippled childhood is painted out, and another, showing the healthy child, substituted, we shall never get full value for our money in our public elementary schools, and we shall be constantly adding to the number of men and women badly equipped for the battle of life.

The bad effects of mouth breathing are due to the inhalation of air that is dry, dirty, and cold, and all of these qualities, which are the reverse of what is normal, produce evil results, such as I have described. When we consider the huge number of pathogenic organisms that must be always floating in the atmosphere of towns, and which is ever on the move from the effect of wind and traffic, especially in these days of the rapid motor car, we must see to what a danger of infection the unfortunate mouth-breathing child is subjected. When we remember how frequent is the association of diseased tonsils and tubercular affection of glands in their neighbourhood, we see at once the direct results of inefficient nasal breathing, both in supplying the germs direct to the mouth and throat without the filtering action of the nose, and in arranging for an easy path of entrance to the glands through the diseased tonsillar tissues.

Coughs due to bronchial or pulmonary trouble and asthma we know

to be very prevalent in children into whose lungs dry, cold, dirty air is constantly admitted as in mouth breathers. Dyspepsia, from constant swallowing of mucous secreted; disturbance of sleep from cough, and night terrors from insufficient oxygenation of the blood during the night, laryngismus stridulus, with the fright thus engendered, are all serious bars to development.

Badly-shaped thorax, pigeon-breast, etc., is very apt to make its appearance in these ill-nourished children, partly because they are ill-nourished, but also because of the difficulty with which they suck in air, especially at night, through the stenosed nostrils.

When we consider the ear we find a terribly sad state of things going on due to failure to recognise the nasal and throat affections present. I am constantly treating deaf children, and often can do little for them because of this neglect. Stenosis of the nostrils, with or without adenoids, is a very serious factor in the deafness of children. It is not merely a question of a mechanical closure of Eustachian tubes by growth in the naso-pharynx. It is caused usually, in these cases, by the congestion and inflammation that is kept up in the nostrils, in the naso-pharynx, and in the tubes. Of course the adenoid growth, if present, adds to this, and also and very greatly the tenacious mucous that is so abundantly secreted.

I would earnestly plead for the most vigilant observation and careful treatment of constant colds in children. They are the most frequent of all causes of deafness in young people, and there must be accuracy of diagnosis to enable us to treat these so-called colds successfully. They may be due to adenoids or there may be merely some hypertrophy of the lymphoid tissue in the naso-pharynx, not worthy of the name adenoid growth, or there may be an inflamed hypertrophied nasal mucous membrane. With all this comes the thick mucous secretion in increased quantity and of abnormal quality and inflamed, more or less blocked Eustachian tubes and the terrible affliction deafness. It is surprising to me to see how little attention ear discharge gets from the whole community. It is lamentable to have to tell parents, as so often falls to my lot to do, that they have allowed so much of the membrana tympani to be destroyed, along with other middle-ear structures, it may be, that there is no hope of the little patient again hearing perfectly.

I often feel sad at what I see, in my own practice, of deafness in children. Deafness unnecessary, and preventible! Deafness irremediable only because the abscess in the middle ear has been treated differently from what it would be did it exist in any other part of the body. Carelessness and indifference sum up the treatment. "Merely

an ear discharge" is all that is said, and it may be for years, and so nothing sensible is done.

Further than this, every aurist knows how considerable is the proportion of discharging ears that need mastoid operation, if life is to be saved. Yet it is not too much to say that all this suffering, all this crippling, can be avoided if, *directly* the ear discharge makes its appearance, it is treated by a competent medical attendant.

I do not propose to describe the treatment of the affections of throat, nose, and ear, and of their pathological results, but I should like to say that, whilst I never operate if the objects that one wishes to obtain by operation can be obtained without it, I frequently see cases where it is necessary. I wish, therefore, to protest strongly against statements that have been made that operations on the nose, and especially on adenoids and faucial tonsils, ought not to be done because nasal exercises, etc., will do all that is requisite. These statements are untrue if made in relation to cases such as a conservative conscientious surgeon would select for operation. They are, however, true of many cases, and in my own practice I use non-operative measures wherever practicable, and always insist on parents carrying out for a long period of time a scheme of nasal breathing exercises with which I always furnish them, to be put in practice after operation.

But to refuse operation where necessary is merely to sacrifice a patient's well-being and to lose time that can never be regained.

SOME SUGGESTIONS FOR IMPROVING THE HEALTH OF ELEMENTARY SCHOOL CHILDREN.

By MISS F. MARION TOWNSEND.

ABSTRACT.

WHILE purposely omitting the question of medical inspection, which will be dealt with by others, I wish to set before you three points:—

(1). *The necessity of securing adequate and nourishing food to all school children, and the possibility of accomplishing this without unduly burdening the State or relieving parents of responsibility.* It is an accepted fact that in every large town hundreds of school children attend school in an ill-nourished condition, rendering them physically unfit to profit by the instruction given. During the past year an attempt has been made to deal with these children through the Relief (School Children) Order issued to Boards of Guardians. The carrying out of this Order bristles with difficulties, and its operations have not been universally successful. It has also one great drawback, it hardly reaches the children who most need help. A greater number of children suffer from *improper* feeding than from underfeeding, or (as the word has been widely interpreted) semi-starvation. Improper feeding is not touched by legislation. The question is how may both sets of children, the improperly-fed and the under-fed, be provided with at least one wholesome, nourishing meal every day. Much might be done towards this if, in every poor district where the standard of living is low, food depots were established at or in connection with central elementary schools. Meals should be provided at from a penny to three-pence. Where possible, parents should pay; where poverty prevents, this payment should be made by the education authority or some voluntary agency. The system would be similar, in a modified form, to that which exists in Paris, where every school has its canteen, and between ten and eleven million meals are supplied annually. It is also successfully carried out in connection with various central

schools for the teaching of defective children. The food depot should also be the means of establishing a closer relationship between school and home. Each depot might be made a homely school of cookery for mothers. The homes should be visited and mothers persuaded to come to the depots for lessons in the preparation of simple nourishing dishes. Every effort should be made to bring about a reformation in the diet given *at home*, but meanwhile do not let children suffer for want of suitable food.

(2). *The need of establishing a closer connection between school and home, so that hygienic measures begun at school may, as far as possible, be carried on in the home.* In infant schools an open afternoon for mothers should be held once a month, when as many mothers as possible should be urged to attend. Simple talks on the management of children, their diet, hours of sleep, common ailments, etc., should be given. "Health Tracts" should be distributed and commented on. Mothers and teachers should confer *re* the care and management of individual children. It would be well to secure the aid of voluntary workers, district nurses, etc. Working in connection with the teachers, and in constant consultation with them, these visitors could do much more than at present to secure better health conditions for children. The want of systematic co-operation between municipal and voluntary agencies is a distinct waste of power.

(3). *The need for greater knowledge, supervision and care of individual children during the years of school attendance in order to prevent* (A) *over pressure;* (B) *neglect of minor ailments and spread of disease;* (C) *continued uncleanliness of the person or clothing of any child.* This need could best be met by the appointment by the Town Council in every large town of Women Health Visitors, to work under the Medical Officer of Health or the school doctor. Officially appointed, such trained women would have more authority in the homes of the people than an ordinary district or school nurse, and could thus secure better treatment for neglected or mismanaged children. If they worked in close connection with the poorer elementary schools their services would be valuable in many ways. I will mention one or two as illustration :—

(*a*) Some children are unduly pressed into school when physically weak and unfit, while some are allowed to stay away for insignificant causes, because the attendance officer has insufficient knowledge to deal rightly with each case. All doubtful cases could be referred to the Woman Health Visitor, who would visit, inquire, get medical advice if necessary, guard the unfit child from over-pressure, and the malingerer from escaping due attendance at school.

(*b*) Bad consequences frequently arise from neglected small ailments, and from inefficient nursing of the non-notifiable infectious diseases, measles, chicken-pox, etc. Health visitors could follow up these cases, and by persuasion or, if necessary, coercion, secure such isolation as was possible in the home, proper treatment and care during illness and convalescence.

(*c*) Every persistent case of uncleanliness in a school-child could be referred to the health visitor, who would visit, give instructions to the mother in cleansing heads, clothing, etc., and *see that those instructions were carried out.*

Dr. McCormack (Bootle) pointed out that all responsibility is being removed from the shoulders of the parent. The readers of the various papers not only want the children educated, but also wish the children to be treated by throat, ear and eye specialists, fed, clothed, looked after in their own homes, and treated for the ordinary ailments of childhood, and all this at the expense of the Education Committee. This will entail the expenditure of very large additional sums of money, which ratepayers can ill afford.

Mr. A. F. Somerville (Somerset C.C.) considered that elementary education was conducted too much on the principle that the earning of grants was the main object. The attendance of the mentally deficient child had a money worth equal to that of the child who really benefited by the instruction. He suggested that it would be better, both from a mental and physical aspect, that children who were dull and whose future vocation would be that of manual labour or domestic service should be allowed to leave school at the age of 12. He advocated that girls of this class should be allowed to be with their mothers from 12 to 14 or 15, after which they could go into service. These suggestions were made with a regard to the physical development of these children, which he contended would only be retarded by their remaining longer at school when their mental powers were practically gaining no advantage.

DIET IN BOARDING SCHOOLS.

By J. ODERY SYMES, M.D., D.P.H., M.R.C.S., L.R.C.P.,

Assist.-Physician, Bristol General Hospital; Physician to Clifton College.

THE best method of ascertaining whether the dietary supplied at school is satisfactory in quality and quantity is by observing the general health of the child, and by systematically taking observations of the height, chest measurement, and weight, noting whether there be a satisfactory increase in these measurements, and comparing them with a table of standard measurements of similarly conditioned children. In the case of boys, Duke's Table, showing the average height, weight, and chest measurement of English public school boys, may be taken as a standard:—

AGE.	HEIGHT.		WEIGHT.		CHEST GIRTH.
	Ft.	Ins.	St.	Lbs.	Ins.
13	4	10½	6	0¼	28½
14	5	0¾	6	9	29½
15	5	3	7	5½	30¾
16	5	5	8	4½	32½
17	5	7	9	2½	34½
18	5	8	9	11	35½

The following table refers to girls of all classes, and is taken from the Report of the Anthropometric Committee, 1883. Height, without shoes and average weight, with clothes:—

AGE.	HEIGHT.		WEIGHT.	
	Ft.	in.	St.	Lbs.
13	4	9¾	6	3
14	4	11¾	6	12¾
15	5	7	7	8¼
16	5	1¾	8	1
17	5	2½	8	3½
18	5	2½	8	9

From such tables parents may learn that the growth of a child is not uniform year by year, but that from the tenth to fifteenth year growth is

most rapid in girls; whilst in boys the increase is greater between the ages of fifteen and twenty. Girls show the minimum of growth during the ninth, the maximum during the thirteenth year; boys show a minimum during the eleventh, and a maximum during the sixteenth year.

If parents would take the trouble to take such measurements at stated intervals, and would submit their children during health to periodical medical examination, they would be conferring a lasting benefit upon the children, and would at the same time be obtaining information enabling them to determine whether the children were being adequately fed at school. As an alternative I would suggest that the school authorities in making the periodical reports on the pupil's progress should include a record of such measurements—this information being certainly as important as that relating to the child's general conduct or position in form.

One of the great difficulties in the feeding of children at school is due to injudicious feeding during the holidays. If a child is allowed at home to dine late and to have unlimited supplies of made-up dishes and sweets he is hardly likely to appreciate the return to plain school fare. Again, unless habits of eating slowly and of refraining from food between meals are taught during early years, and enforced during the holidays, they can never be inculcated by the teacher.

If a boy or girl complains that the school food is unpalatable or insufficient the parents' remedy lies in a complaint to the teacher. Parents tell me that they do not like to make such complaint as it may lead to unpleasantness for the child. The more usual procedure is therefore either to send the child a hamper or to increase the supply of pocket money. In either case the result is the same, namely, that the child eats a supply of undesirable food between meals and still further neglects the food provided at meal times. If the keeping of grub-shops and the receiving of hampers were prohibited there would be fewer complaints of defective feeding. Parents should treat the school authorities with greater frankness in this matter, and credit them with a greater share of common-sense and desire for the well-being of their pupils.

Before leaving this aspect of the question I should like to point out the importance of greater care being paid to the cleanliness and repair of children's teeth. Before entering boarding-school, and once a year during their stay at school, the child should visit the dentist and have all defects made good. Most schools have a routine medical inspection, and a routine dental inspection is of scarcely less importance. The work of stopping or regulating need not necessarily be done during the term, but the dentist's report should be sent to the parent.

Quantity of Food.

The school-boy between the ages of thirteen and eighteen requires as much food as the adult, for he has to supply the waste consequent upon his ceaseless activity, and at the same time to provide for rapidly-growing tissues. The routine of school work and athletics is a very heavy strain upon the boy's system, and the amount of food consumed should be greater during the term than during the holidays. When the strain of book-work, or of games, or of both, becomes excessive the appetite fails, less food is taken, and a vicious circle is established. It is not sufficiently appreciated that a flagging boy or girl is often as readily restored by a few days' rest as by increased time given to physical exercise.

With plain school fare there is no fear of children over-eating, indeed the difficulty is to ensure that they get enough. A second helping is often refused by the child because it is not the custom to have second helpings, and children dread being peculiar, or the time given for the meal may be insufficient, or the waiting so defective that only those served first have a chance of a second helping. Variety in food is essential if the appetite is to be maintained, and attention paid to the cooking and serving of meals will be amply repaid by the increased healthiness of the school.

Hours of Meals.

The two most important points with regard to school meals are that the breakfast should be given as soon as possible after rising, and that no heavy meal should be given later than three hours before bed-time. The time given before breakfast to preparation of lessons is in my opinion wasted. The child, after the night's rest, has been fasting for about ten hours, and this is essentially the time to feed and not to work him. Both boys and girls should be encouraged to take a cold bath and then have breakfast served within half-an-hour of rising.

I know that school authorities will complain and say that this morning work is most important; but surely it is possible to secure the required thirty-five or forty-five hours of work per week without perpetuating this most objectionable custom of study before breakfast. The practice of giving coffee or cocoa with biscuits directly after rising, and breakfast an hour or an hour-and-a-half later, does not in my opinion improve matters. In the rush and hurry many boys neglect it altogether, and others who take it lose appetite for breakfast. Tea, the last substantial meal of the day, should not be later than 7 o'clock for boys who are to be in bed at 10. During the winter months tea will generally be served much earlier.

The actual time spent at table should be fixed, twenty minutes for breakfast and half-an-hour for dinner and tea.

We may now consider the meals seriatim :—

BREAKFAST.

This should be made a far more substantial meal than is usual at school, and should consist of porridge with milk and sugar or treacle, tea, coffee, or cocoa, bread and butter, bacon, eggs, ham, brawn, pressed beef, fish or sausages, together with jam and marmalade or fresh fruit in summer. I am often told that children (especially girls) do not like porridge, but this is partly, I think, because plain oatmeal is used or because insufficient milk and no sweetening agent is allowed. If some newer preparation, such as Quaker Oats or Provost Oats is employed there is a great saving in the time required for cooking, and the porridge is much more appreciated by the children. A liberal helping of sugar or treacle is a valuable addition to the child's dietary. Even the heartiest child will tire of a breakfast of porridge and bread and butter, and the majority of children require that something else should be provided. I need not enter into details as to suitable articles; they are such as we provide for our own breakfast tables. The neglect of proper breakfast provision is more common at girls' schools than at boys' schools, though it is as much needed by girls as by boys.

In schools where the fees are low, or in schools supported as charities, it is often stated that the funds will not permit of any addition to the ordinary bread and butter breakfast. In such a case it would be better to lessen the amount spent for educational work, or to diminish the amount of food at some other meal. At my suggestion some eighteen months ago an addition of nitrogenous food was added to the ordinary breakfast of porridge and bread and butter at a large girls' school. The food provided was either an egg, brawn, pressed beef, or cold bacon, and on account of scarcity of funds this could only be provided three days a week. The improvement in the general health has been most marked, and the necessity for medical attendance has diminished by twenty-five per cent. The cost of such provision amounted to about £80 a year, or 1¾d. a head per diem, for ninety girls. There had been no diminution in the amount of bread consumed, pointing to the fact that the general appetite has been increased.

If breakfast is at eight o'clock and dinner at 1.30, many children will feel the interval between meals is too long, and there should therefore be a simple lunch of bread and butter, biscuits, or a bun, and milk at eleven o'clock. Boys should not, however, at this hour be allowed to partake of unwholesome food from their own hampers or the grub-shop.

DINNER.

The quantity and quality of food provided for this meal is generally satisfactory, the chief difficulties are poor cooking and insufficient service. It should be the teacher's care to see that due attention is paid to these points. The ordinary meal of meat, vegetables, and pudding might more often be supplemented by the addition of soup, this being one of our most valuable appetisers and aids to digestion. A healthy boy or girl should, as a rule, require a second helping of meat (a helping of meat weighs from two to two and a-half ounces), more especially so in those institutions which do not provide meat at other meals, and where the amount of milk consumed does not exceed a pint a day per head. The provision of ale with dinner or supper is unnecessary, and modern scientific work points to the injurious effect of alcohol in any form, more especially upon young persons.

TEA.

This should be made a more substantial meal than is the case at present, and should be served at six or six-thirty. It should be under the immediate supervision of the teacher, otherwise boys are likely to indulge in the most injudicious forms of food. Meat with tea is a most undesirable mixture, and one which is most likely to give rise to indigestion. Fish, eggs, potted meat or fish, brawn, and salads may be given together with cake, scones, jam, marmalade, and bread and butter. An occasional change in the make of bread should be afforded, and a certain proportion of brown or whole-meal bread should be provided. It is a good general rule to forbid the use of all tinned foods, as cases of poisoning occasionally arise from such, and as these foods are often kept too long after opening and undergo decomposition.

SUPPER.

This should not be a set meal, but for such boys as require it there should be a supply of milk or cocoa, and bread and butter, or biscuits, to be taken half-an-hour before going to bed. Nothing can be more prejudicial to the moral and physical welfare of boys than partaking of a solid meal with alcohol at or immediately before bedtime.

With regard to all meals I think it is not sufficiently recognised that in order to obtain the full benefit of food it should be eaten with interest and enjoyment. Digestion depends chiefly upon appetite, and appetite is excited by the organs of sight and smell, and by pleasant mental impressions. It is important, therefore, that food at school should be cooked carefully and served daintily. There should be as little as possible of routine in school fare, and everything should be done to discourage children rushing their meals in order to get to work or to play.

A PLEA FOR THE TEACHING OF DOMESTIC HYGIENE.

By ALFRED GREENWOOD, M.D., D.P.H.,

Medical Officer of Health for Blackburn.

(MEMBER.)

SO many instances of mismanagement on the part of the housewife at home have come to my notice recently, that I thought it would be of interest to this Congress if I gave my impressions and suggestions on this subject.

Last year I conducted an enquiry into the extent of underfeeding amongst school children of Blackburn, and a number of interesting facts came to light, which have an important bearing upon the social habits of the working classes of this town.

It is needless to say there were many difficulties, such as an unwillingness of many people to supply information as to the addresses of families where underfeeding was suspected; the hesitation of some parents in answering questions of a private nature, such as income and expenditure; the difficulty of obtaining accurate information regarding habits of parents, etc.

During my enquiry attention was given to such points as the number in family, ages, occupation, wages, sanitary condition of the home, rent, cost of clothes, food, coal, clubs, habits of parents, etc.

The result of my investigation showed that not more than 1·3 per cent. of the Blackburn school children were underfed, and I formed the opinion that the question was one rather of the quality than the quantity of the food given.

Many homes were visited in which considerable waste occurred through a lack of knowledge as to cheap, nutritious articles of diet, and economical cooking. In other words, the money might be made to go further in some families by the exercise of a little extra care and additional teaching.

It is important that the elder girl scholars should be taught the

preparation and cooking of such meals as are available in a working man's home. This is more important than a knowledge of the preparation of fancy dishes.

It is also important that the mothers should have an opportunity of receiving similar instruction, including economical shopping, and gaining an elementary knowledge of the nutritious value of various articles of food.

The difference between mothers of families receiving the same wages is very striking. Some mothers have no idea of mending clothes, making broths, systematic cleansing of house or person, and the numerous other details which make all the difference between comfort and the reverse. Indeed, I found several cases of underfeeding amongst children as a result of causes within the control of the parents such as alcoholism, laziness, indifference and bad management.

In order to obviate some of the dangers resulting from a lack of knowledge of this branch of hygiene, courses have been arranged at Blackburn for girls who have left school and for mothers. These lessons are conducted by various head teachers, who have themselves been instructed in the subject.

The following is the syllabus which has been prepared for this purpose:—

DOMESTIC HYGIENE.

A brief description of the human body, its functions and requirements:—

A healthy home.
Fresh air.
Light.
Warmth.
Cleanliness.
Space.
Order.
Some dangers of dirt.
Good food.
Digestion and indigestion.
The choice of food.
How to keep and store food.
The feeding and care of young children.
How to dispose of kitchen refuse.
What to drink.
Beverages.
Healthy habits.
Clean bodies (skin, hair, teeth).
Baths, hot and cold.
Clothing, and its choice.
Work, rest, and play.
How to deal with simple accidents which may occur at home.
Home nursing.
Management of a sick room.
Care of the sick.

During the next session a few lessons will also be given to mothers regarding the food, work, and care which are desirable before and after pregnancy. It is singular how many erroneous and dangerous practices

are carried out in this age of civilisation. In my own town many women believe firmly that they may get up and go about as usual two or three days after confinement, provided they go back to bed on the ninth day! The danger of such a procedure is obvious.

It is probable that the recent legislation in the Midwives Act of 1902 will have the effect of producing a better type of nurse in confinement cases. Midwives can do much useful work not only in guiding the mother but in giving instruction regarding the feeding and care of infants. It is therefore important that midwives also should receive a sound training in the principles of domestic hygiene.

Instruction given on lines similar to those indicated above cannot fail in a few years to have most beneficial results.

MEDICAL INSPECTION OF SCHOOLS.

By JAMES KERR, M.A., M.D., D.P.H.

(FELLOW.)

EDUCATION has become all embracing. Every child has to be educated. The country's educational bill runs into millions; but wastage is enormous, wastage in two ways. The first is most obvious, on buildings and furniture which are unsuitable; schools which err in some hygienic provisions before they are built so that later either costly remedies have to be found, or the schools have to be continued under conditions making for inefficiency.

The second is in misdirected education; ten per cent. of the children in the elementary schools are receiving instruction from which they will not get permanent benefit, from which they may get lasting damage.

Apart from this there exists a further national wastage in insidious disease, or permanent injury resulting from trifling conditions being allowed to persist unchecked.

The first purpose of school is to train children to play their part as good citizens of the commonwealth, and the first purpose of medical inspection is to fit children to benefit by schooling.

Medical inspection has come in the popular mind to be associated with certain things, which are incidentals, but are not the whole object of medical inspection itself, in fact are but small objects in the field, and these parts of the work are often confused with the purposes of medical inspection, or even taken for the whole work itself.

One of the chief of these is the prevention of contagious disease. It has been proposed to have, and in America, where zeal sometimes outruns wisdom, there are places where doctors and nurses attend daily in the schools to see the children and arrest diseases. This certainly is a case of wasting the ratepayers' money to little purpose.

Practically there are three diseases concerned in school life: these are measles, which is almost incontrollable; scarlet fever, which can be to some extent controlled; and diphtheria, which, if the doctor is permitted, can be suppressed and prevented; but prevention can be attained, through

the interest and knowledge of teachers under general medical supervision to quite as practical an extent as by a perfunctory daily doctor's visit, and at a comparatively insignificant cost.

Another subject taking an important place in the public mind, so important indeed that local education authorities frequently consider it as an isolated matter, is the vision of school children. Ten per cent. of school children in large towns have bad vision, the percentage is lower in country districts. A considerable part of this is due to various catarrhal conditions and is eminently preventable, but a good deal is also due to nervous strain.

The subject has been fairly well understood for 30 or 40 years past, but still it is supposed that spectacles are the remedy for each child. Very few children really require glasses or ought to need them, the things wanted are well-lighted school buildings, clean windows, suitable furniture, and tasks which are reasonable and suitable.

The school doctor should be an official attached to every school; no school can be said to be likely to be properly conducted which is not under his surveillance. In elementary schools this should be required as a condition of grant. He should attend to all matters likely to affect the health of those who work in school, and the Board of Education should satisfy themselves of the efficiency of the work done, for the health of school children is of national import, should be a national concern, and so requires supervision by the Central Educational Authorities.

At present the things that have already been spoken about require attention, but more fundamental matters need to be dealt with too.

The teachers do what can be expected of them, but teachers had been teaching for half a century and the inspectors passing children as satisfactory, when some were literally crawling with vermin, and in most schools classes could be found where forty or fifty per cent. of the girls presented evidence of vermin in their hair!

These are the fundamental matters that the school doctor has to begin with. The children whose clothes are sewn on them, and the children who sit up at night because there is no room in bed for them, or as a note I read some time ago said, "six people in the one room and two children who sleep in the ash-bin." The relief of verminous bodies is only beginning, and there is no general system of cleansing baths in our schools as there is abroad.

These are very shocking incidents, but the important point is that they existed and were generally passed over until the doctor began to visit the schools.

The whole educational method, the process of fatigue, the large part of each hour's teaching efforts which in younger children is wasted from the failure of their brains to retain the work impressed upon them, are matters which in due time will come into the doctor's consideration.

In England, at any rate, the separation of children according to their mental capacity has been largely due to the doctor.

The economical possibilities of early treatment of chronic cases, of tuberculous and debilitated children, by months if need be of country or seaside with modified schooling, has not yet been appreciated. The need of holiday camps for boys, and of training to strive for an object which all can struggle towards, marksmanship.

It is difficult to say where the school doctor's work shall definitely end, his work is medical, psychological, pedagogical. It must to some extent overlap the psychologist's field, and even invade the teacher's domain. Here in this borderland all must work as colleagues, administrator, doctor, and teacher; but hitherto in one direction a sharp limit has always been fixed, treatment.

The medical treatment of all cases has been always held to be beyond the function of the public authority. It is my own doctrine. It has consequently been left to parents, who as a rule are ignorant of the importance of treatment and neglect it, or take the child to a hospital, where in many cases the same result comes about.

I doubt whether this doctrine of non-treatment will be justifiable in the future. The treatment of an ailing child, the relief of matters which may affect its whole life seems sometimes even more necessary as a public duty than its feeding. The school doctor, as a public official, must also protect the child and the community.

It is notorious that in certain matters affecting the public health many members of the medical profession seem quite wanting in conscience. They will certify a child as free from disease the day after it has been excluded from school on the positive result of a bacteriological examination for diphtheria, or as fit to attend school whilst obviously suffering from infective conditions of ringworm or scabies.

In other matters where a child has disease the parent, not impressed with the importance of treatment, often neglects this, especially in cases which in school are common and chronic. The efforts of the teachers, however, often get such children taken to hospitals, but for these diseases it is very doubtful whether the benefits derived from the hospital are worth the trouble of attendance.

Chronic eye cases are often practically neglected with placebos, other

refraction cases put off and off, or a pedantic prescription given for unnecessarily expensive glasses which the people cannot afford, and the child does not get. Discharging ears are neglected with the instruction to syringe them, and so on. And the cases are uninteresting, tedious and toilsome to deal with, their number is so great that a conscientious handling of each case would break down the hospital service in a week, and, indeed, if the children seen by the school doctors in a week all went to hospital there would be little else to do for other patients for the rest of the year.

The next step forward in public health will be the provision of treatment for all such common defects as are a nuisance or a risk to the public without being an actual danger to life. Vermin, for instance, defects of vision remediable by glasses, the treatment of chronic aural discharge (a condition popularly regarded as trifling, but presenting a very unfavourable and fatal outlook if left unrelieved), and such generally non-fatal but troublesome and offensive diseases due to vermin or parasites. These are likely to need consideration as to whether they should not be prevented at the public cost.

School doctors then are wanted to visit schools regularly, to make teachers acquainted with the hindrances to education among the children under their charge, to bring to light various conditions bearing on health and capable of relief, to put into their proper perspective conditions like the existence of infectious disease, visual troubles or sanitation of school houses, which at present are given an exaggerated importance to the neglect of other important matters—such as the early beginnings of disease or defects likely to seriously affect the mental or physical capacity in later life—educational habits or methods which may be hurtful.

All these form a large field which in England remains almost unexplored. It requires workers, but the school doctors should be men or women appointed for this purpose. The school work should not be shelved by being merely added on to an already overworked medical officer of health, still less should it be given to an assistant, wherewith to fill in his spare time.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

LIGHT.—*Ancient Lights—Easement—Alteration of Dominant Tenement—Increased Burden on Servient Tenement—Destruction of Easement—Action for Declaration that there is no Easement.*

The plaintiffs were the owners of a piece of land adjoining the defendant's premises. The latter consisted of a house with a backyard open to the sky. In the house there were on the ground floor two ancient lights looking into the yard. At the other end of the yard was a shed which derived light from the yard, to which one of its sides was open, and from an ancient light looking on to the plaintiffs' land. The defendant pulled down his house and rebuilt it, preserving the ancient lights. He raised the wall between his yard and the plaintiffs' land, and left in it the window to the shed and two apertures to give light to the yard. He covered in the yard so as entirely to shut out all light except that which came through the apertures. He pulled down hoardings which the plaintiffs had erected to close the apertures and the shed window, and they brought this action against him for a declaration that he was not entitled to any easement over their land for light and air:—

Held, that the defendant had increased the burden on the plaintiffs' land; it was impossible to sever the burden and say that he was still entitled to impose on the plaintiffs' land the burden which had previously existed; he could no longer maintain an action against the plaintiffs for interference with his ancient lights; he had no right which could be enforced; and therefore that the plaintiffs were entitled to the declaration they claimed.

ANKERSON *v.* CONNELLY (Warrington J., 544). Vol. II., Ch. 1906.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT THE BRISTOL CONGRESS.

RECOMMENDATION MADE IN SECTION I.—

> "That this Congress urge the Council of The Royal Sanitary Institute to represent to His Majesty's Government the desirability of submitting to the next Imperial Conference proposals for a system of Imperial Notification of Infectious Diseases."

The Council have written to His Majesty's Secretary of State for Foreign Affairs, representing the importance of taking steps at the earliest opportunity to secure an international notification of the chief infectious diseases liable to be spread by international communication.

THE HENRY SAXON SNELL PRIZE.

The subject given this year for the Essay in competition for this Prize was "Suggestions for Improvements in Sanitary Appliances for use in Workmen's Dwellings and Labourers' Cottages, under the varying conditions of water supply and drainage usually obtaining in towns and villages." Nine Essays were sent in and have been brought under the consideration of the Council.

Acting upon the advice of the Adjudicators appointed by them, the Council have decided to divide the prize between two essayists, whose essays are about equal in merit, and they have awarded to Mr. John R. Preston, M.R.San.I., Leicester, writing under the motto of "John of Gaunt," and to Mr. E. H. Parkinson, Architect and Surveyor, Bradford, writing under the motto of "Spero Meliora," each the sum of Twenty-five pounds and a Bronze Medal of the Institute.

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KENNY & CO., PRINTERS, 25, CAMDEN ROAD CAMDEN TOWN, LONDON. N.W.

JOURNAL SUPPLEMENT

OF

THE ROYAL SANITARY INSTITUTE.

TRANSACTIONS.—VOL. XXVII.

1906.

LONDON:

OFFICES OF THE INSTITUTE, MARGARET STREET, W.

EDWARD STANFORD, LONG ACRE, W.C.

1907.

ABSTRACTORS OF TITLES OF ARTICLES RELATING TO PUBLIC HEALTH.

H. ADAMS, M.INST.C.E.

H. E. ARMSTRONG, D.HYG.

PROF. H. R. KENWOOD, M.B., D.P.H.

C. MASON, ASSOC.M.INST.C.E.

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H. A. ROECHLING, ASSOC.M.INST.C.E.

J. OSBORNE SMITH, F.R.I.B.A.

SUPPLEMENT.

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THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

HYGIENE.*

The present issue has been completely revised, and in several parts rewritten, some new matter being also introduced. The bacteriological examination of water samples has been very carefully but succinctly treated, and the account of the processes of infection, immunity and protection has also received careful revision, and well deserves the closest study. In every respect the new edition has been brought thoroughly up-to-date; and not only does it contain a vast amount of useful and reliable information on every subject with which it deals, but where it treats of matters of a speculative nature, the authors are always careful to present the questions involved as still *sub judice*, so that no misconception can remain in the mind of the reader as to what statements are based on certain knowledge, and what are still liable to future revision. In dealing so thoroughly and exhaustively, as "Hygiene" does, with every branch and aspect of the science, there has inevitably been a certain amount of compression, but the style and treatment have not been injuriously affected thereby, and the book is emiently readable and interesting throughout. For this reason it can be recommended to the general reader in search of information, as well as to the student in science or medicine. For those preparing for the Diploma of Public Health Examinations the book should afford an excellent groundwork, as within a comparatively small compass it covers pretty well the whole field of study.

L. C. P.

THE LABORATORY BOOK OF DAIRY ANALYSIS.†

The author hopes that this little work "will afford assistance to analysts, health officers, dairy students, and those engaged in the supervision of dairies." Photographic illustrations, possibly suitable for elementary schools, but of little use to analysts, occupy about one-quarter of the volume. Fig. 29, for instance, shows the way to look through a microscope; fig. 20 seems to sanction the practice of placing a bottle of ether in close proximity to a naked flame, and most of the figures contain portraits of the laboratory staff.

A short description of milk and its products is followed by two useful tables of (I.) the average monthly composition of milk morning and evening for 1904

* Hygiene, by J. Lane Notter, M.A., M.D., and R. H. Firth, Lt.-Col. R.A.M.C. Sixth Edition. 477 pp., 8vo.; price 4s. 6d. Longmans, Green & Co.

† The Laboratory Book of Dairy Analysis. By H. Droop Richmond, F.I.C., Analyst to the Aylesbury Dairy Co., Ltd. 90 pp., 8vo. Illustrated with Photographs by the Author. Griffin & Co.

(in which connection it is suggested later in the book that samples should be judged as to genuineness by considering the season, and (II.) the average composition of dairy products. In the chapter on milk analysis, the use of the Westphal balance is not mentioned. The table for calculating milk-sugar from the reduced copper (p. 34) does not explain why one is not strictly proportioned to the other, but the description is made very interesting by the statement that a "policeman" is used for removing the precipitate from the sides of the beaker. The ordinary methods for the various determinations are given sufficiently to refresh one's memory, but hardly with enough care for a person unfamiliar with the subject. No quantitative methods are given for determining preservatives in milk. The method of examining butter-fat is only adapted to the detection of margarine. On p. 74 we find: "Cocoa-nut oil has a rather different composition from that of margarine; but as it lowers the Reichert–Wollny figure, while at the same time raising the potash absorption and lowering the insoluble fatty acids, iodine absorption and the refractometer figure, its detection is not difficult." The last opinion is not generally held. At least two modifications of the Reichart process are directed to the detection of this adulteration; these and the phytosterol test are not even mentioned. The author's quantitative process for boric acid appears less certain than the Thompson method, and surely ·0374 is not the factor for boric acid (as H_3BO_3) with $\frac{N}{4}$ soda (p. 62). ($H_3BO_3 = 62$, $\therefore$ 1 c.c. $\frac{N}{2}$ soda = ·031 gramme). Moreover, this factor does not agree with that given by the author and Mr. Harrison (viz. ·0368) in a paper read before the Society of Public Analysts on April 9th, 1902 (*Analyst* xxvii., 179). A statement (p. 77) that "during ripening (of cheese) . . . . the percentage of volatile acids may be somewhat lowered" does not accord with general experience.

The tables given are useful and well-arranged, and the sections dealing with detection of adulteration from results of analysis are sound and easy to follow.

S. R.

A HOUSING POLICY.*

Mr. Nettlefold at the outset falls into line with most other writers and thinkers of experience in housing matters at the present day, by stating that "the housing problem is something much bigger than a mere question of good sanitation," and that it is impossible to arrive at a sound conclusion on the subject without taking into very careful consideration all the kindred questions, social, industrial, and economic, with which it is so intimately connected. He gives a very interesting account of the efforts made by the Birmingham Corporation to deal with the local housing problem, from the date of the first improvement scheme of that city down to the present time. We are told that, although 653 working class dwellings were demolished under the initial scheme, no serious shortage of house accommodation for the labouring classes was experienced, so long as the natural operation of the law of supply and demand was allowed free play, without interference on the part of the Corporation. In Mr. Nettlefold's opinion, the erection of tenements by the local authority in Birmingham has been a distinct hindrance, instead of a help, to permanent progress in housing reform. The moment, he says, a corporation enters into a business like house building, other people go out of it, because no one can successfully compete with a rate-aided competitor. Every house built by the Corporation has, in the ex-

* "A Housing Policy," by John S. Nettlefold. 104 pp., 8vo. Cornish Bros., Ltd., Birmingham, 1905.

perience of Birmingham, stopped the erection of at least four houses by other people. In support of his argument against cheap house accommodation provided by rate-aided schemes, he quotes Mr. John Burns, to the effect, that cheap house rent at the community's expense would be a grant in aid of lower wages. He prefers to see wages rise to meet the higher rents economically necessary for better houses, as they have risen in England, rather than houses provided, as in Germany, by the State, at unprofitably low rents to meet the lower wages.

Turning now to the improvement and proper maintennce of working-class dwellings, Mr. Nettleford shows that much remains to be done by local authorities, under the Public Health Acts and Part II. of the Housing of the Working Classes Act, 1890, by inducing both owners and tenants to recognise their legal and moral obligations, and gives an interesting account of work of this kind recently done and still in active progress in Birmingham. Obstructive and hopelessly unfit dwellings are pulled down, and confined and unwholesome courts and yards opened up, altered and repaired, at comparatively small expense and much to the advantage alike of owners and tenants. With the view mainly of civilising the rougher and more feckless elements of the working-class population, he advocates the general adoption of Miss Octavia Hill's system of rent collection and sanitary supervision (now obtaining in London, Nottingham, and other places) by ladies specially delegated to such duties. Furthermore, he insists upon the necessity of diminishing the existing facilities for obtaining drink, by reducing the number of houses licensed for the sale of intoxicating liquors. Referring to the questions of land tenure and taxation, he says it is very unsatisfactory that people should be allowed to hold land indefinitely, without paying their proper proportion of the cost of governing the district in which their land is situated. Incidentally he condemns the action of Trades Unions in restricting output, and urges workmen to give a fair and full day's work for a fair day's wage. In a chapter entitled, "The Example of Germany," a short account is given of the system which obtains in several centres, of which Dusseldorf and Ulm are leading examples, under which the municipality purchases a wide belt of country surrounding its own suburbs, and lays it out in plan, before sale, with sufficient broad streets, open spaces, prospective tram routes, and other like desiderata, in such a way as to ensure the subsequent extension of the town upon thoroughly rational lines. The writer considers that the achievement of schemes of this character would be greatly facilitated by the passing of an Act for the taxation of land values, which should provide that the owners of land must declare the value upon which their land is to be taxed, on the distinct understanding that the local authority may purchase their land at that price if they desire to do so.

The book concludes with appendices containing (*a*) the Report of the Birmingham Housing Committee presented to the Council October 20th, 1903, which is to a large extent the text of Mr. Nettlefold's discourse in the book under review, (*b*) some particulars of various Housing Companies, Trusts, and Associations, and (*c*) books of reference to which the author has had access while compiling his "Housing Policy."

Mr. Nettlefold is to be congratulated upon the success of his effort to furnish in the little book before us an instructive and suggestive epitome of the Housing Problem of our great centres of population and the best means of its solution, as these present themselves to a thoughtful and instructed mind at the present day.

P. B.

MALARIAL FEVERS AND MALARIAL PARASITES IN INDIA.*

This is the second edition of a book well known to students in our great eastern dependency, though possibly little familiar to the generality of scientific readers at home. The author does not claim for this book that it is a complete dissertation on the complicated story of malarial fevers and their causative parasites in the blood, but modestly describes it as a record of a series of observations made by himself in Central India and Burmah, in which he has endeavoured to bring the subject-matter up to date. In this respect we think he has been fairly successful, but knowing at what pace the literature on malaria grows, any shortcomings apparent in this volume can be sympathetically overlooked. The book is a very lucid description of the parasitology of malaria, well adapted for the clinical worker and investigator in the tropics. It is well printed, efficiently illustrated, and full of interesting facts: not the least being those which confirm the conclusion that mosquitos really do carry malaria from man to man, a view upon which the first edition threw some doubt. We now learn that the value of the earlier experimental observations were vitiated by working at unfavourable temperatures. Even to the home worker, we think this book cannot fail to be of practical value, while to the native students in the medical colleges of India it appears to be of the first necessity.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

Building Materials, Construction, and Machinery.

Water Supply, Sewerage, and Refuse Disposal.

Heating, Lighting, and Ventilating.

Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions: and Municipal Administration.

CATTELL, ALFRED, J.P. Housing Schemes of the Sheffield Corporation. *Surveyor*, Oct. 13th, 1905, pp. 448–49.

"Croft's" insanitary area—artizans' dwellings in flats—acquisition of properties—rentals—Scotland Street area—suburban schemes—surplus lands—table of cost and accommodation of several schemes in Sheffield.

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* Malaria Fevers and Malaria Parasites in India. by Major Andrew Buchanan, Indian Medical Service. Second Edition. 215 pp., with 16 Plates and 24 Figures. Calcutta: Thacker Spink & Co.

FREEMAN, ALBERT C. Crematoria in Great Britain and Abroad. *Surveyor*, Oct. 20th, 27th, Nov. 3rd, 10th, 17th, 24th, and Dec. 8th.

A series of illustrated and descriptive articles on various crematoria, giving a most interesting and useful history.

SUTCLIFFE, J. D. The Progress of American Schools in regard to Health Laws. *Building News*, Oct. 20th, 1905, pp. 537–38.

Statutory regulations for heating and ventilation—equipment for heating and ventilating, a typical school—comparison of steam and furnace heating—new legislation.

Building Materials, Construction, and Machinery.

HARRIS, THOS. C. A Collapsible Steel Centre for Concrete Sewers. *Engineering Record*, Dec. 2nd, 1905, p. 642.

Illustrated description of collapsible centreing designed by the author for use in forming concrete sewers of oval or circular sections.

Water Supply, Sewerage, and Refuse Disposal.

GRIGGS, JULIAN. The Sewage Purification Works at Columbus, Ohio, U.S.A. *Engineering Record*, Dec. 30th, 1905, p. 730.

Illustrated description of sewage purification works by septic tanks and filter beds.

INGRAM, WILLIAM H., B.A. The Cleansing of Paris; Street Cleaning and House Refuse Removal. *Surveyor*, Ang. 18th, 1905, pp. 246–47.

The staff—hours of work—sweeping machines—street watering appliances—house refuse—night soil—removal of snow—areas and cost.

KERSHAW, JOHN, B. C., F.I.C. Electrolytic Methods of Sewage Sterilization. *Surveyor*, Dec. 1st, 1905, pp. 662–63, and Dec. 22nd, 1905, pp. 749–50.

Electrolysed sea water for disinfecting purposes—theory of process—the Watt cell—Hermite cell—Atkins cell—Woolf cell—electrical efficiencies.

Heating, Lighting, and Ventilating.

ROSENBUSCH, G., Assoc.M.Inst.C.E. The Ventilation of the Baker Street and Waterloo Railway. *Engineering*, Dec. 22nd, 1905, p. 820.

Action of trains on air in tunnels—experiences in ventilating underground railways in London—the exhaust system—test of fan at Waterloo Station—description of method employed.

FORTHCOMING MEETINGS.

Sessional Meetings.

Manchester, Feb. 2nd Discussion on "Meat Inspection," to be opened by Prof. A. Sheridan Delépine, M.B., B.Sc., and on "Jointing of Pipes for Drains and Sewers," by Prof. J. Radcliffe, C.E.

Saturday, Feb. 3rd. Visit to Foreign Animals Wharf, Lairage, and Slaughter-houses at Old Trafford.

London, Feb. 14th. Discussion on "Is the Intercepting Trap a Failure?" to be opened by W. Butler, M.B., D.P.H., and R. Read, A.M.Inst.C.E.

Leicester, March 24th. Paper on Cremation, with particulars of the Leicester Corporation Crematorium, by C. Killick Millard, M.D., D.Sc., M.O.H. Visit to the Crematorium.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances under the Public Health Act, 1875—
Glasgow, February 9th and 10th.

In Hygiene in its bearing on School Life—
London, February 16th and 17th.

Lectures to Sanitary Officers.

The Forty-first Course of Lectures and Demonstrations to Sanitary Officers will commence on Monday, February 12th. The Lectures are arranged to include the subjects scheduled for the examination for Inspector of Nuisances held by The Royal Sanitary Institute and the Sanitary Inspectors' Examination Board (formed by The Sanitary Institute and other bodies).

Lectures on Sanitary Science as applied to Buildings and Public Works.

A Course of Lectures has been arranged to assist those desiring instruction in Sanitary Science as applied to Building and Public Works, suitable to Foremen of Works, Builders, and those engaged in Allied Trades, Managers of Property, Teachers and Lecturers, and others who are desirous of obtaining the Certificate of the Institute in Sanitary Science as applied to Buildings and Public Works.

Inspections and Demonstrations are arranged, and include visits to Disinfecting Stations, Municipal Depôts, Artizans' Dwellings, Waterworks, Sanitary Works in Progress, Refuse and Sewage Disposal Works, etc., etc., and other Public and Private Works illustrative of Sanitary Practice and Administration.

The Course will commence on February 21st.

Course of Lectures on Hygiene in its bearing on School Life.

This Course of Lectures has been arranged to assist Teachers and others interested in the training of children and the structural conditions of the School, who purpose entering for the Examination of the Institute in Hygiene in its bearing on School Life.

The Course will commence on February 19th.

Course of Practical Training for Meat Inspectors

for candidates preparing for the Examination for Inspectors of Meat and Other Foods, conducted by The Royal Sanitary Institute.

The Seventh Course will commence on February 22nd, and will consist of systematic Practical Training in the inspection of meat at a Cattle Market, including Demonstration on live cattle and sheep, slaughtering and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangements of markets and byres, etc.

Demonstration will also be arranged at a knacker's yard, where instruction regarding the flesh and organs of the horse will be given.

The Course will continue for two months.

Demonstrations will be given at the Institute on Friday evenings and at a Market on Saturday afternoons.

In addition to the Practical Training at a Market, the Course will include the Lectures on Meat and Food Inspection given in the Parkes Museum.

Special Course on Food and Meat Inspection.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Students preparing for the Examination for Inspection of Meat and Other Foods, conducted by The Royal Sanitary Institute, will commence on April 20th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

Calendar, February and March, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

FEBRUARY.

2 F. **Sessional Meeting,** at 11 a.m., MANCHESTER. Discussion on "Meat Inspection," to be opened by Prof. A. S. Delepine, M.B., B.SC., and on "Jointing of Pipes for Drains and Sewers," to be opened by Prof. J. Radcliffe, C.E.

3 S. Visit to Public Abattoirs, Manchester.

9 F. }
10 S. } Examination in Sanitary Science as applied to Building and Public Works, and for Inspectors of Nuisances, Glasgow.

12 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

13 T. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

14 W. **Sessional Meeting,** at 8 p.m., LONDON. Discussion on "Is the Intercepting Trap a Failure?" to be opened by W. Butler, M.B., D.P.H., M.O.H., Willesden, and R. Read, ASSOC. M.INST.C.E., City Surveyor, Gloucester.

16 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

16 F. }
17 S. } Examination in Hygiene in its bearing on School Life, London.

19 M. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

19 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by G. Newman, M.D., D.P.H., F.R.S.E., M.O.H., Finsbury.

21 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

21 W. Demonstrations in the Parkes Museum, at 6 p.m., Building Materials and Construction, by the Director, E. White Wallis, F.S.S.

21 W. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

21 W. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General B: Indoor, by G. Newman, M.D., D.P.H., F.R.S.E.

22 Th. Lecture. Meat Inspectors' Course at 6.30 p.m.

23 F. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

23 F. Demonstrations in the Parkes Museum, at 6 p.m., Baths and Lavatories, by the Director, E. White Wallis, F.S.S.

23 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by G. Newman, M.D., D.P.H.

24 S. Demonstration. Meat Inspectors' Course at 2 p.m.

24 S. Inspection and Demonstration at the Willesden Infirmary, at 3 p.m. Conducted by A. Saxon Snell, F.R.I.B.A.

26 M. Demonstrations in the Parkes Museum, at 6 p.m., Waste Preventers and Water Closets, by the Director, E. White Wallis, F.S.S.

26 M. Lecture to Sanitary Officers at 7 p.m. Infectious Diseases, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H. Lewisham,

28 W. Lecture to Sanitary Officers at 7 p.m. Methods of Disinfection, by A. Wellesley Harris, M.R.C.S., D.P.H.

MARCH.

2 F. } 3 S. } Examination in Hygiene in its bearing on School Life, Blackburn.

2 F. Lecture to School Teachers at 7 p.m., "Food and Clothing," by Col. J. Lane Notter, R.A.M.C.

2 F. Lecture to Sanitary Officers at 7 p.m. Elementary Statistics, by D. Wellesley Harris, M.R.C.S., D.P.H.

3 S. Inspection and Demonstration at Tottenham Disinfecting Station and Dust Destructor. at 3 p.m. Conducted by J. F. Butler-Hogan, B.A., M.D., Medical Officer of Health, Tottenham.

3 S. Demonstration—Meat Inspectors Course at 2 p.m.

5 M. Lecture to School Teachers at 7 p.m. "Physical Exercises and Accidents," by Philip Boobbyer, M.D., M.S.

6 T. Lecture to Sanitary Officers at 7 p.m. Elementary Physics, by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

7 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

7 W. Lecture to Sanitary Officers at 7 p.m. Elementary Physics, by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

9 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry," by E. J. Steegmann, M.B., M.R.C.S.. D.P.H.

9 F. } 10 S. } Examination in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Birmingham.

10 S. Inspection and Demonstration at the Battersea Disinfecting Station, Mortuary, and Shelter, at 2.15 p.m. Conducted by G. F. McCleary, M.D., D.P.H., M.O.H., Battersea.

12 M. Demonstration on Pipe Joints, etc., and Drain Testing Appliances in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

12 M. Lecture to School Teachers, at 7 p.m., "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

12 M. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry and Meteorology," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Carrington House, Deptford, S.E., at 3 p.m.

14 W. Lecture—Sanitary Science Course, at 7 p.m. Analysis of Air and Water, by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

16 F. Lecture to Sanitary Officers at 7 p.m. Calculations, Measurements, and Plans and Sections, by W. C. Tyndale, M.INST.C.E.

16 F. } 17 S. } Examination for Inspectors of Meat and other Foods, Sheffield.

17 S. Demonstration—Meat Inspectors Course, at 2 p.m.

17 S. Inspection and Demonstration at the Sewage Works, Sutton, Surrey, at 3 p.m. Conducted by C. Chambers Smith, Town Surveyor.

19 M. Lecture to Sanitary Officers at 7 p.m. "Building Materials," by A. Saxon Snell. F.R.I.B.A.

20 T. Lecture to School Teachers at 7 p.m. "School Furniture," by Prof. H. R. Kenwood, M.B.

21 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

21 W. Lecture to Sanitary Officers at 7 p.m. "Sanitary Building, Construction, and Planning: Soil and Local Physical Conditions," by A. Saxon Snell, F.R.I.B.A.

23 F. Lecture—Meat Inspectors Course, at 6.30 p.m.

23 F. Lecture—Sanitary Science Course, at 7 p.m. Sanitary Building, Construction (Advanced), by A. Saxon Snell, F.R.I.B.A.

24 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

24 S. **Sessional Meeting,** at 11 a.m., LEICESTER. Discussion on "Cremation, with particulars of the Leicester Corporation Crematorium," to be opened by C. Killick Millard, M.D., D.SC., M.O.H. Visit to the Crematorium.

26 M. Demonstration on House Drainage in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis.

27 T. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper St., Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

27 T. **Annual Meeting of Associates in the Parkes Museum** at 8 p.m.

28 W. Lecture to Sanitary Officers at 7 p.m. Details of Plumbers' Work, by J. Wright Clarke.

30 F. Demonstration on Water Supply in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

30 F. Lecture to Sanitary Officers at 7 p.m. Ventilation, Warming, and Lighting, by A Saxon Snell, F.R.I.B.A.

31 S. Demonstration—Meat Inspectors Course at 2 p.m.

31 S. Inspection and Demonstration at Morden Hall Dairy Farm, Morden, Surrey, at 3 p.m. Conducted by Oscar J. White.

APRIL.

25 W. **Ordinary General Meeting.**

JULY.

9–14 **Congress and Exhibition, Bristol.**

LIST OF MEMBERS AND ASSOCIATES ELECTED.

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

2020 1906. Jan. AMYOT, John A., M.B., *Director of Laboratory of Provincial Board of Health of Ontario, Toronto, Canada.*

2021 1906. Jan. CONNELL, Prof. W. T., M.D., M.R.C.S., *Kingston, Ontario, Canada.*

2022 1906. Jan. DAVIS, William Mahlon, *Civil Engineer, Berlin, Waterloo, Ontario, Canada.*

2023 1906. Jan. GALT, John, *Civil Engineer, Toronto, Canada..*

2024 1906. Jan. MACFARLANE, Thomas, 317, *Queen Street, Ottawa, Canada.*

2025 1906. Jan. MATHEW, Harold B., *The Borough Engineer's Office, Dover.*

2026 1906. Jan. McNAUGHT, James Gibson, MAJOR R.A.M.C., M.A., M.D., D.P.H., 16, *Westhall Gardens, Edinburgh.*

2027 1906. Jan. MONTIZAMBERT, Frederick, I.S.O., M.D., F.R.C.S.E., D.C.L., *Director-General of Public Health, Ottawa, Canada.*

2028 1906. Jan. NOBBS, Percy E. H., M.A., A.R.I.B.A., *Professor of Architecture, McGill University, Montreal, Canada.*

2029 1906. Jan. OLDRIGHT, William, M.A., M.D., *Toronto, Ontario, Canada.*

2030 1906. Jan. *AUSTIN, Charles Armstrong, 37, *Howley Place, Paddington, W.*

2031 1906. Jan. *CLEGG, William Benjamin, 61, *Stamford Street, East Bowling, Bradford.*

2032 1906. Jan. *COMYN, Heaton, A.R.I.B.A., 57, *Gloucester Gardens, Hyde Park, W.*

2033 1906. Jan. *DUNGAY, Alfred Henry, 63, *Princess Street, Camberley.*

2034 1906. Jan. *HEWITT, Frank, 87, *Sarsfield Road, Balham, S.W.*

2035 1906. Jan. *LARKE, James Phillippo, 66, *Wisteria Road, Lewisham.*

2036 1906. Jan. *MIDDLETON, Ernest, *The Public Health Dept., Wellington, New Zealand.*

2037 1906. Jan. *NUGENT, Ebenezer, *The Hawthorns, Ryde Vale, Balham, S.W.*

2038 1906. Jan. *TINSON, John, "*Brimley,*" *Heath Road, Harrow-on-the-Hill.*

2039 1906. Jan. *TUCK, Frederick Grant, *Sanitary Inspector, Newtown, Sydney, New South Wales.*

2040 1906. Jan. *TURNER, Joseph, 4, *Hopewell Terr., Matlock, Derby.*

ASSOCIATES.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

3718 1906. Jan. ‡Akers, Thomas Henry, 36, *Trererton Street, North Kensington.*
3719 1906. Jan. ‡Allen, Francis Henry, 28, *High St., Kettering.*
3720 1906. Jan. ‡Allwright, Francis, 9, *High Street South, Ealing.*
3721 1906. Jan. ‡Annakin, Edward, 20, *Bower Road, Harrogate.*
3722 1906. Jan. ‡Ashman, Richard William, 16, *Montrose Avenue, Redland Bristol.*
3723 1906. Jan. ‡Baxter, Walter, 9, *King Street, Normanton.*
3724 1906. Jan. ‡Bird, George W., *Surveyor, Ripley, Derby.*
3725 1906. Jan. ‡Brain, Albert Harry, *High Street, Staple Hill, near Bristol.*
3726 1906. Jan. ‡Butler, William Henry, 6, *Elderslie Road, Eltham.*
3727 1906. Jan. ‡Carr, John Gould, 237, *Lillie Road, Fulham, S.W.*
3728 1906. Jan. ‡Carr, Walter Louis, *Surveyor and Inspector, Northwood.*
3729 1906. Jan. ‡Clarke, John Henry, 13, *Harpur Street, Bedford.*
3730 1906. Jan. ‡Coales, Miss Alice Emily, 10, *Royal Crescent, Weston-super-Mare.*
3731 1906. Jan. ‡Cranfield, Charles Bennett, *Barnsland, Westend, Southampton.*
3732 1906. Jan. ‡Crawshaw, John Edwin, 115, *Haworth Terrace, Plantation Street, Accrington.*
3733 1906. Jan. ‡Cumming, James, 32, *Harlesden Road, Willesden Green, N.W.*
3734 1906. Jan. ‡Davies, Archibald John Devereux, 3, *Prendergast Hill, Haverfordwest.*
3735 1906. Jan. ‡Dean, William James, *Asst. San. Insp., Shanghai, China.*
3736 1906. Jan. ‡Driscoll, Robert, 11, *Ascot Terrace, East End Park, Leeds.*
3737 1906. Jan. ‡Dyson, Stafford, 198, *New Hey Road, Huddersfield.*
3738 1906. Jan. M Gaiger, Sydney Herbert, M.R.C.V.S., 18, *Gonville Road, Thornton Heath.*
3739 1906. Jan. ‡Gibbs, William Charles, 6, *Southcote Road, Tufnell Park, Holloway, N.*
3740 1906. Jan. ‡Griffiths, Theodore, *Prestwich, near Manchester.*
3741 1906. Jan. ‡Hammerton, Ernest, *The Poplars, Darfield, near Barnsley.*
3742 1906. Jan. ‡Harris, Henry William, *Mayberry, Jubilee Road, Weston-super-Mare.*
3743 1906. Jan. ‡Harris, Richard, *Little Marlow Rd., Great Marlow.*
3744 1906. Jan. ‡Heath, Harry Vernon, *Forton Hall, Newport, Shropshire.*
3745 1906. Jan. ‡Hitchings, Miss Lottie, 800, *Ashton New Road, Clayton, Manchester.*

3746 1906. Jan. *HOOKE, Fred J., 93, *Hampstead Road, N.W.*
3747 1906. Jan. ‡HOOPER, Sergt.-Major Arthur. *Depot Gloucester Regt., 4, Court Road, Horfield, Bristol.*
3748 1906. Jan. ‡JUPE, James Augustus, *London House, Ferriers, High Wycombe.*
3749 1906. Jan. ‡LAING, Charles Alexander, 1, *Harrison Road, Edinburgh.*
3750 1906. Jan. ‡LLOYD, Albert Edward, *Borough Surveyor, Higham Ferrers.*
3751 1906. Jan. ‡LOCK, Frederick Charles, 15, *Maude Road, Camberwell, S.E.*
3752 1906. Jan. ‡MARTLAND, John, B16, *Queen Insurance Buildings,* 10, *Dale Street, Liverpool.*
3753 1906. Jan. ‡MITCHELL, Oscar Parish, 10, *Sea Terrace, Middleton, Hartlepool.*
3754 1906. Jan. ‡NASH, James Charles, 237, *High Street, Rochester.*
3755 1906. Jan. ‡OLD, Miss Laura, 6, *Park Crescent, Weston-super-Mare.*
3756 1906. Jan. ‡PICKERING, Harold, *Summerhill Place, Newcastle-on-Tyne.*
3757 1906. Jan. ‡PLEWES, Harold, *Surveyor and Inspector, Goole, Yorks.*
3758 1906. Jan. ‡PRATT, Ernest F. A., *London County Asylum, Bexley, Kent.*
3759 1906. Jan. ‡RAGG, George William, 16A *Barnsbury Park, N.*
3760 1906. Jan. ‡READ, George James Percy, 203, *High Street, Pendleton, Manchester.*
3761 1906. Jan. ‡ROBINSON, Miss Adelaide, 23, *St. Michael's Road, Northampton.*
3762 1906. Jan. ‡STROUD, Athelstan Harvey, *Witham Villa, Bolton Road, Upper Edmonton, N.*
3763 1906. Jan. ‡TAYLOR, Alfred Henry, 96, *Golbourne Road, North Kensington.*
3764 1906. Jan. ‡TAYLOR, Walter Floyd, 19, *Church Road, Upper Norwood.*
3765 1906. Jan. ‡THORPE, Wilfrid, 171, *Manchester Road, Denton, Lancs.*
3766 1906. Jan. ‡TURNBULL, Frank, 32, *Baldovan Terrace, Dundee.*
3767 1906. Jan. ‡WILLIS, Joseph Alexander, 12, *Clarence Street, Morecambe.*
3768 1906. Jan. ‡WILSON, George Edward, 25, *Joicey Street, Sherburn Hill, Durham.*
3769 1906. Jan. ‡WOOLDRIDGE, Miss Lavinia Hannah, *Blyth Bridge, Stoke-on-Trent.*
3770 1906. Jan. ‡WRIGHT, William Henry Bulbeck, *Asst. Surveyor, Totton, near Southampton.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (BRITISH).

London. *Institution of Civil Engineers.* Minutes of Proceedings, with other selected and abstracted papers. Vol. CLXII. 488 pp., 8vo. London, 1905. *The Institution.*

——— *Institution of Mechanical Engineers.* Proceedings, March–May, 1905. 225 pp., 8vo. London, 1905. *The Institution.*

Binnie, *Sir Alexander.* Presidential Address to Institution of Civil Engineers, Nov. 7th, 1905. 20 pp., 8vo. London, 1905. *The Author.*

Board of Education. Outline Scheme for teaching Hygiene and Temperance to the Scholars attending Public Elementary Schools. 16 pp., 8vo. London, 1905. *Purchased.*

Hill, *Leonard, M.B., F.R.S.* Physiology for Beginners. 124 pp., 8vo. London, 1905. *The Publisher (E. Arnold).*

Local Government Board. Report of Dr. E. P. Manby upon the sanitary circumstances and administration of the Barnard Castle and Startforth Rural Districts comprised within the Teesdale Union. 12 pp., fcp. London, 1905. *W. H. Power, C.B., F.R.S.*

London. *King Alfred School Society.* Report of the Council, 1904–5. 24 pp., 8vo. London, 1905. *The Society.*

Massachusetts, *State Board of Health.* Twenty-sixth Annual Report. 448 pp., 8vo. Boston, 1905. *The Board.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, November, 1905.. .. *Matthew Hay, M.D.*

Glasgow, San. Insp., 1904 .. .. *Peter Fyfe.*

Nabarro, *D., M.D., D.P.H.* The Laws of Health. 184 pp., 8vo. London, 1905. *The Publisher (E. Arnold).*

Tasmania, *Department of Public Health.* Handbook and Model By-laws under "The Public Health Act, 1903," for the use of Local Authorities and others concerned in Local Sanitary Administration. 83 pp., 8vo. Hobart, 1905. *The Department.*

LIST OF EXHIBITS ADDED TO THE MUSEUM.

Flooring. "Stonwod" preparation, fireproof. Laid with rounded angles and skirting in w.c. and urinal. *Stonwod Flooring Co.*

Electric Lighting. Case containing several types of "Linolite" Electric Lamps, and Reflectors. Diagrams, &c. *The Linolite Co.*

"**Terrasso.**" Special material in concrete laid near Platform, Museum, and Science room. *W. B. Simpson & Co.*

GENERAL NOTES.

CONGRESS, 1906.

The next Congress of the Institute will be held in Bristol from July 9th to 14th, 1906.

The following Sections and Conferences have been arranged:—

Section I. Sanitary Science and Preventive Medicine.
 „ II. Engineering and Architecture.
 „ III. Physics, Chemistry, and Biology.

Conference of Municipal Representatives.
 „ Engineers and Surveyors to Municipal Authorities.
 „ Medical Officers of Health.
 „ Veterinary Inspectors.
 „ Women on Hygiene.
 „ on the Hygiene of School Life.

The Exhibition will be held in the Drill Hall, Queen's Road, from July 9th to 21st. With this number of the Journal is enclosed a Member's application form for Tickets for the Meeting.

The Committee will be glad to receive any offers of papers for the Congress from Members; those wishing to contribute should send in their names as early as possible to the Secretary.

SEVENTH INTERNATIONAL CONGRESS OF ARCHITECTS,

LONDON, 1906.

This Congress will be held in London from July 16th to 21st, 1906, organised by the Royal Institute of British Architects.

The subjects for Discussion have been arranged as follows:—

1. The Execution of important Government and Municipal Architectural Work by Salaried Officials.
2. Architectural Copyright and the Ownership of Drawings.
3. Steel and Reinforced-Concrete Construction:
   (*a*) General aspect of the Subject.
   (*b*) With special reference to Æsthetic and Hygienic considerations in the case of very high buildings.

4. The Education of the Public in Architecture.
5. Statutory Qualification for Architects.
6. The Architect-Craftsman: How far should the Architect receive the theoretical and practical training of a Craftsman?
7. The Planning and Laying-out of streets and open spaces in cities.
8. To what extent and in what sense should the Architect have control over other Artists or Craftsmen in the completion of a National or Public Building?
9. The Responsibilities of a Government in the Conservation of National Monuments.
10. The Organisation of Public International Architectural Competitions.

The Executive Committee will be glad to receive offers of papers before April 25th, written in English, French, Italian, or German.

In connection with the Meeting an Exhibition will be organised, the chief features of which will be—

1. A Chronological Exhibition of English Architecture from the Norman Conquest (1066) to the death of Sir Charles Barry (1860).
2. Oil Paintings and Water Colour Drawings of English Architecture.
3. English Furniture and Silver Work.

The minimum subscription of Members is £1.

Full particulars of the Meeting can be obtained from the Secretary, Seventh International Congress of Architects, 9, Conduit Street, London, W.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
AMOUNT ALLOTTED BY COUNCIL	9,000	0	0
CONTRIBUTIONS AND DONATIONS PROMISED 1899–1904	1,101	13	0
CONTRIBUTIONS, 1905, ALREADY REPORTED, EXCLUDING GUARANTEE FUND	1,227	4	6

Contributions since last report.

		£	s.	d.
J. BLENCH			10	6
G. F. BULMER	during five years	2	12	6
JAMES COOK			10	6
DR. SORAB. C. HORMUSJEE	during five years	2	12	6
MISS E. L. MAYNARD	during two years	1	1	0
DR. J. ASHBURTON THOMPSON		10	10	0
G. WILSON			10	0
Other Amounts			18	0

THE ROYAL SANITARY INSTITUTE.

MEETINGS HELD.

Sessional Meetings.

Manchester.—The Meeting was held in the Municipal School of Technology, on February 2nd, 1906, when a discussion on "Meat Inspection" was opened by Prof. A. Sheridan Delépine, M.B., C.M., B.Sc., and on "The Jointing of Pipes for Drains and Sewers" by Prof. J. Radcliffe, C.E. The chair was taken by Col. J. Lane Notter, M.A., M.D. About 300 Members and Associates were present. Visits were made on the 3rd to the Foreign Animals Wharf, Lairage, and Slaughter-houses, when the members were entertained at tea by Alderman McCabe.

London.—The meeting was held in the Parkes Museum on Feb. 14th, 1906, when a discussion on "Is the Intercepting Trap a Failure?" was opened by Wm. Butler, M.B., D.P.H., and R. Read, Assoc.M.Inst.C.E. The chair was taken by O. Claude Robson, M.Inst.C.E.

Bristol Congress, 1906.

A Public Meeting was held in Bristol on February 2nd, 1906, when the Lord Mayor presided. It was announced that the Right Hon. Sir Edward Fry, P.C., LL.D., D.C.L., F.R.S., had accepted the Presidentship of the Congress. The Lord Mayor accepted office as Vice-President, Dr. Colston Wintle was elected as Chairman of the Local Committee, and Mr. T. J. Moss-Flower, Assoc.M.Inst.C.E., as Hon. Local Secretary.

The following Sections and Conferences have been arranged:—

Section I. Sanitary Science and Preventive Medicine.
President—Sir Wm. J. Collins, M.D., F.R.C.S., B.Sc., D.P.H., J.P., M.P.

„ II. Engineering and Architecture.
President—Edwin T. Hall, V-P.R.I.B.A.

„ III. Physics, Chemistry, and Biology.
President—W. N. Shaw, M.A., D.Sc., F.R.S.

Conferences.

Municipal Representatives.
President—Counc. Colston Wintle, M.R.C.S., *Chairman, Health Committee, Bristol.*

Medical Officers of Health.
President—D. S. Davies, M.D., D.P.H., *Medical Officer of Health, Bristol.*

Engineers and Surveyors to Municipal Authorities.
President—H. Percy Boulnois, M.Inst.C.E.

Veterinary Inspectors.
President—Frank Leigh, F.R.C.V.S.

Sanitary Inspectors.
President— A. E. Hudson, *Chief Sanitary Inspector, Cheltenham.*

Women on Hygiene.
President—Her Grace the Duchess of Beaufort.

The Hygiene of School Life.

The Exhibition will be held in the Drill Hall, Queen's Road, from July 9th to 21st. With this number of the Journal is enclosed a Member's application form for Tickets for the Meeting.

The Committee will be glad to receive any offers of papers for the Congress from Members; those wishing to contribute should send in their names as early as possible to the Secretary.

Arrangements have been made with the various Railway Companies to issue return tickets to Bristol at a single fare and a quarter, from July 5th to 23rd.

EXAMINATIONS.

Sanitary Science as applied to Buildings and Public Works.

Plymouth.	January 26 and 27.	3 Candidates; no Certificate was granted.
Glasgow.	February 9 and 10.	1 Candidate; 1 Certificate granted.

Inspectors of Nuisances.

Plymouth.	January 26 and 27.	19 Candidates; 10 Certificates granted.
Glasgow.	February 9 and 10.	12 Candidates; 8 Certificates granted.

Hygiene in its Bearing on School Life.

London.	February 16th and 17th.	5 Candidates; 3 Certificates granted.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES.

In Sanitary Science as applied to Buildings and Public Works.

MILLAR, DAVID.

Inspectors of Nuisances.

AINLEY, ALBERT.
ANDREWS, THOMAS WILLIAM.
BASFORD, ROBERT.
BEALE, ALBERTA MAUDE.
BELL, WILLIAM G.
COUNTER, WILLIAM JOHN.
CROSSLEY, HERBERT.
DUNCAN, JAMES.
GREIG, THOMAS.
HILL, CHARLES WILLIAM.
HUGHES, WM. HERBERT.
KIRK, WILLIAM WATERS.
McKINNON, HUGH.
NAUGHTON, HAROLD FRANCIS.
SMITH, JAMES.
SOUTHON, EDGAR GILBERT.
TILLBROOK, THOMAS JOHN.
TRANT, BERTRAM PEDRICK.

Hygiene in its Bearing on School Life.

BOX, MARY BLANCHE.
CURWEN, IRENE.
GRIESS, KATHERINE ELIZABETH.

FORTHCOMING MEETINGS.

SESSIONAL MEETINGS.

Leicester, March 24th. Paper on "Cremation," with particulars of the Leicester Corporation Crematorium, by C. Killick Millard, M.D., D.Sc., M.O.H. Visit to the Crematorium.

London. Discussion on "Treatment of Pulmonary Tuberculosis outside Hospitals and Sanatoria," to be opened by G. A. Heron, M.D., D.P.H., F.R.C.P.

LECTURES.

Special Course on Food and Meat Inspection.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Students preparing for

the Examination for Inspection of Meat and Other Foods, conducted by The Royal Sanitary Institute, will commence on April 20th.

Courses of Lectures are now in progress for—
Sanitary Officers.
Hygiene in its Bearing on School Life.
Practical Training for Meat Inspectors.
Sanitary Science as Applied to Buildings and Public Works.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

EXAMINATIONS.

In Sanitary Science as Applied to Buildings and Public Works—
Birmingham, March 9th and 10th.

Inspector of Nuisances—
Birmingham, March 9th and 10th.

In Hygiene in its Bearing on School Life—
Blackburn, March 2nd and 3rd.
Birmingham, March 9th and 10th.

Inspectors of Meat and other Foods—
Sheffield, March 16th and 17th.

CALENDAR, MARCH AND APRIL, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

MARCH.

2 F. Lecture to School Teachers at 7 p.m. "Food and Clothing," by Col. J. Lane Notter, R.A.M.C.

2 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. } Examination in Hygiene in its bearing on School Life, Blackburn.
3 S. }

3 S. Inspection and Demonstration at Tottenham Disinfecting Station and Dust Destructor, at 3 p.m. Conducted by J. F. Butler-Hogan, B.A., M.D., Medical Officer of Health, Tottenham.

3 S. Demonstration—Meat Inspectors Course at 2 p.m.

5 M. Lecture to School Teachers at 7 p.m. "Physical Exercises and Accidents," by Philip Boobbyer, M.D., M.S.

6 T. Lecture to Sanitary Officers at 7 p.m. "Elementary Physics," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

7 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

7 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Physics," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

9 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. } 10 S. } Examination in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Birmingham.

10 S. Inspection and Demonstration at the Battersea Disinfecting Station, Mortuary, and Shelter, at 2.15 p.m. Conducted by G. F. McCleary, M.D., D.P.H., M.O.H., Battersea.

12 M. Demonstration on Pipe Joints, etc., and Drain Testing Appliances in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

12 M. Lecture to School Teachers, at 7 p.m., "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

12 M. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry and Meteorology," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Carrington House, Deptford, S.E., at 3 p.m.

14 W. Lecture—Sanitary Science Course, at 7 p.m. "Analysis of Air and Water," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

16 F. Lecture to Sanitary Officers at 7 p.m. "Calculations, Measurements, and Plans and Sections," by W. C. Tyndale, M.INST.C.E.

16 F. } 17 S. } Examination for Inspectors of Meat and other Foods, Sheffield.

17 S. Demonstration—Meat Inspectors Course at 2 p.m.

17 S. Inspection and Demonstration at the Sewage Works, Sutton, Surrey, at 3 p.m. Conducted by C. Chambers Smith, Town Surveyor.

19 M. Lecture to Sanitary Officers at 7 p.m. "Building Materials," by A. Saxon Snell, F.R.I.B.A.

20 T. Lecture to School Teachers at 7 p.m. "School Furniture," by Prof. H. R. Kenwood, M.B., D.P.H.

21 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

21 W. Lecture to Sanitary Officers at 7 p.m. "Sanitary Building Construction and Planning: Soil and Local Physical Conditions," by A. Saxon Snell, F.R.I.B.A.

23 F. Lecture—Meat Inspectors Course, at 6.30 p.m.

23 F. Lecture—Sanitary Science Course, at 7 p.m. "Sanitary Building Construction" (Advanced), by A. Saxon Snell, F.R.I.B.A.

24 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

24 S. **Sessional Meeting,** at 11 a.m., LEICESTER. Discussion on "Cremation, with particulars of the Leicester Corporation Crematorium," to be opened by C. Killick Millard, M.D., D.SC., M.O.H. Visit to the Crematorium.

26 M. Demonstration on House Drainage in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

26 M. Lecture to Sanitary Officers at 7 p.m. "Sanitary Appliances," by W. C. Tyndale, M.INST.C.E.

27 T. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper St., Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

27 T. **Annual Meeting of Associates in the Parkes Museum** at 8 p.m. Address on "Buildings in Garden Cities," by H. D. Searles Wood, F.R.I.B.A.

28 W. Lecture to Sanitary Officers at 7 p.m. "Details of Plumbers' Work," by J. Wright Clarke.

30 F. Demonstration on Water Supply in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

30 F. Lecture to Sanitary Officers at 7 p.m. "Ventilation, Warming, and Lighting," by A. Saxon Snell, F.R.I.B.A.

31 S. Demonstration—Meat Inspectors Course at 2 p.m.

31 S. Inspection and Demonstration at Morden Hall Dairy Farm, Morden, Surrey, at 3 p.m. Conducted by Oscar J. White.

APRIL.

2 M. Lecture to Sanitary Officers at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.

4 W. Inspection and Demonstration at the East London Water Works, Lea Bridge, Clapton, at 3 p.m. Conducted by Mr. Blackburn, Deputy Engineer.

4 W. Lecture to Sanitary Officers at 7 p.m. "Water Supply," by J. E. Worth, M.INST.C.E.

6 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

6 F. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D.

6 F. Lecture to Sanitary Officers at 7 p.m. "Water Composition," by A. Wellesley Harris, M.R.C.S., D.P.H.

6 F.–7 S. Examination in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Liverpool.

7 S. Demonstration—Meat Inspectors Course at 2 p.m.

7 S. Inspection and Demonstration at the Sewage Outfall Works, Barking, at about 3 p.m. Conducted by J. E. Worth, M.INST.C.E.

9 M. Lecture to Sanitary Officers at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.

10 T. Lecture to Sanitary Officers at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.

11 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt. Public Health Department, Borough of Islington.

11 W. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D., D.P.H.

11 W. Lecture to Sanitary Officers at 7 p.m. "Scavenging," by J. E. Worth, M.INST.C.E.

13 F.–16 M. **Easter Holidays.** Library and Museum closed.

25 W. **Ordinary General Meeting** at 4.30 p.m.

MAY.

9 W. **Annual Dinner of the Institute.** The President of the Institute, His Grace The Duke of Northumberland, will take the Chair.

JULY.

9–14 **Congress and Exhibition, Bristol.**

FELLOW, MEMBERS, AND ASSOCIATES ELECTED.

Reg. No. Date of Election.

FELLOW.

711 1906. Feb. BURGESS, Samuel Edwin, M.INST.C.E., *Borough Engineer & Surveyor, South Shields.*

MEMBERS.

* Passed Examination in Sanitary Science as applied to Buildings and Public Works.
‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

2041 1906. Feb. ANDREWS, George Samuel Burt, M.INST.C.E., *Town Engineer, Johannesburg, S. Africa.*

2042 1906. Feb. AVELING, Thomas Clifford, ASSOC.M.INST.C.E., *Central House, New Street, Birmingham.*

2031 1900. May. BOTTOMLEY, Prof. W. B., M.A., PH.D., F.L.S., F.C.S., *King's College, W.C.*

2043 1906. Feb. CHESSON, Herbert, D.P.H.LOND., M.R.C.S., L.R.C.P., 13, *Park Court Mansions, Clapham Park Rd., S.W.*

2044 1906. Feb. FROGLEY, James Henry, ASSOC.M.INST.C.E., *Lakeside, Bradshaw, Bolton, Lancs.*

2045 1906. Feb. S HALSEY, Miss Evangeline, 4, *West View, Washwood Heath Road, Saltley, Birmingham.*

2046 1906. Feb. S‡MOSS, Miss Alice Emily, 74, *Tennyson Road, Small Heath, Birmingham.*

2047 1906. Feb. NIGLEY, James, "*Highcliffe,*" *Fulwich Road, Dartford, Kent.*

2048 1906. Feb. ‡PETTIT, George M., 71, *St. Quintin Avenue, North Kensington, W.*

2049 1906. Feb. *REYNOLDS, George Henry, 49, *Morehall Avenue, Folkestone.*

2050 1906. Feb. RODDICK, Thomas F., M.D., LL.D.EDIN., *Dean of Faculty of Medicine, McGill University,* 80, *Union Avenue, Montreal, Canada.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Sanitary Inspectors.

3771 1906. Feb. ‡ABBOTT, Arthur Joe, 5, *High Street, Totnes.*

3772 1906. Feb. ‡ANDREWS, Thomas William, 18, *Northumberland Place, Teignmouth, Devon.*

3773 1906. Feb. ‡BASFORD, Robert, *Pioneer Sergt., 2nd Somersetshire L.I., Crown Hill R.S.O., Plymouth.*

3774 1906. Feb. ‡BEALE, Miss Alberta Maude, 21, *Stuart Rd, Stoke, Devonport.*

3775 1906. Feb. ‡BROOKS, Henry, 135, *Avenue Road, Stoke Road, Gosport, Hants.*

Reg. No.	Date of Election.		
3776	1906.	Feb.	‡Clarke, Thomas William, *Coop Street, Horbury, near Wakefield.*
3777	1906.	Feb.	‡Dillingham, Stuart S., *Elm Villa, New Bedford Road, Luton, Beds.*
3778	1906.	Feb.	‡Durkin, John Thomas, 18, *Straker Street, West Hartlepool.*
3779	1906.	Feb.	‡Ellis, Walter, 13, *Wentworth Terrace, Wakefield.*
3780	1906.	Feb.	‡Hagley, Charles E., *Sanitary Inspector, Claremont Municipality, Cape Town,*
3781	1906.	Feb.	‡Hardy, William, 75, *Roundhill Street, Bradford, Yorks.*
3782	1906.	Feb.	‡Hay, Henry T., 39, *Park Street, Grimsby, Lincoln.*
3783	1906.	Feb.	‡Herrin, John, 119, *Stormont Road, London, S.W.*
3784	1906.	Feb.	‡Hogarth, Miss Ada Alice, 14, *St. Cuthbert's Road, Moor Park, Preston.*
3785	1906.	Feb.	‡Hughes, William Herbert, *Bryndarren, Aberdare, Glam.*
3786	1906.	Feb.	‡Jarvis, Miss Mary Sprott, 116, *Gt. Western Street, Moss Side, Manchester.*
3787	1906.	Feb.	‡Johnson, William, 12, *Dene View, Wallsend-on-Tyne.*
3788	1906.	Feb.	‡Kitchin, Richard Walter, 10, *Glenholme Road, Manningham, Bradford.*
3789	1906.	Feb.	‡Lamond, John, 93, *Woodbine Avenue, Wallsend.*
3401	1901.	Apr.	‡Ley, E. J., 1, *Stanley Road, Oldfield Park, Bath.*
3790	1906.	Feb.	‡Morrison, Ivor Charles, "*Alma,*" *St. Albans, Herts.*
3791	1906.	Feb.	‡Price, Richard Edward, 62, *New St., Mold, Flint.*
3792	1906.	Feb.	‡Rance, Alfred, *Hadley Cottage, Cavendish Street, Claremont, Cape Colony, S. Africa.*
3793	1906.	Feb.	‡Reinherz, Miss Ella, 9, *Heaton Grove, Bradford.*
3794	1906.	Feb.	‡Southon, Edgar Gilbert, *Sarnden, Benenden, Cranbrook, Kent.*
3795	1906.	Feb.	‡Stone, William James, 38, *Keble Road, Bootle, Liverpool.*
3796	1906.	Feb.	‡Tait, Leonard, *Isolation Hospital, Morpeth Common, Northumberland.*
3797	1906.	Feb.	‡Tilbrook, Thomas John, 96, *South View Terrace, Plymouth.*
3798	1906.	Feb.	‡Trant, Bertram Pedrick, "*Frittiscombe,*" *Chillington, Kingsbridge, Devon.*
3799	1906.	Feb.	‡Turner, John, 14, *Vale Terrace, Peirey, Waterfoot, near Manchester.*
3800	1906.	Feb.	‡Walker, William Waite, 3, *Stumperlowe Avenue, Fulwood, Sheffield.*

GENERAL NOTES.

Henry Saxon Snell Prize.

THE Henry Saxon Snell Prize was founded to encourage improvements in the construction or adaptation of sanitary appliances, and is to be awarded by the Council of The Royal Sanitary Institute at intervals of three years, the funds being provided by the legacy left by the late Henry Saxon Snell, F.R.I.B.A.

The prize will consist of £50 and a medal of the Institute, and is offered in the year 1906 for an Essay on "Suggestions for Improvements in Sanitary Appliances, for use in workmen's dwellings and labourers' cottages under the varying conditions of water supply and drainage usually obtaining in towns and villages."

Essays must not consist of more than 5,000 words, and must be delivered before September 30th, 1906.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	5	17	6

Contributions since last report.

	£	s.	d.
Anthony Buxton		10	6
H. Catchpole		10	6
F. W. King (2nd donation)	1	1	0
The Worshipful Company of Skinners	25	0	0
Sir Henry Tanner ... ... during five years	5	5	0
Other Amounts		6	0

Feb. 26th, 1906.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

PRACTICAL SANITARY SCIENCE.*

This book is described in the preface as "a brief summary of the course of practical lecture demonstrations given to the D.P.H. class at King's College, London." Looking at it from this point of view, it may at once be said that the book possesses some value. It gives, in many instances, very fair descriptions of analytical processes, such as would enable students to work them out satisfactorily by themselves.

On almost every page, however, there is evidence that the work has been compiled by one who is not a trained professional chemist, while moreover, there are many mistakes to be found, which detract from its value as a laboratory guide.

As an instance of this, one can mention on page 25, the directions for preparing a solution for the estimation of hardness, where the following occurs:—"Dry, at 120° C. some powdered $CaCl_2$ (calcite) for half an hour, and weigh out one gramme into a porcelain basin. Add a few drops of HCl, and to avoid loss by spirting, cover the basin with a watch glass. Evaporate to dryness." Calcite is not calcium chloride, but calcium carbonate, and this is the substance undoubtedly meant.

Again, on page 32, under the quantitative estimation of sulphuric acid, it is stated that the sulphuric acid is returned as $\frac{40}{233}$ of the weight of sulphate of barium obtained. This would give a result only one half of that really found.

Again, under Air Analysis, referring to the detection of carbon disulphide in air, it is suggested that this being a liquid at ordinary temperatures, a drop could be collected on a porcelain lid and set alight, the yellow deposit of sulphur left behind being noted. It would be very interesting to know how, in practice, this result is to be obtained.

An appendix forms part of the volume, in which certain tables appear, and also methods for the preparation of standard solutions, and it is interesting to note that the quantities given in the appendix, in some instances, are different to those given in the text of the book. Notably is this the case in the making of a standard solution of calcium chloride for the estimation of hardness, before referred to, and also in the preparation of Nessler's Solution.

The subject of the Bacteriological Examination of Water would have been much better omitted than put in the form in which it appears, where it only occupies two pages and a quarter. Anyone conversant with work of this type will know how impossible it would be to give an inkling of the necessary laboratory work under this head in such a short space.

Perhaps the best chapter of the book is that given to the interpretation of water results, and it is pleasant to be able to commend this as giving a good resumé of the subject as at present understood.

The book is illustrated throughout, some of the illustrations being exceptionally good, while others are by no means satisfactory. One cannot help feeling,

* Practical Sanitary Science. By David Somerville, B.A., M.D.

however, that it is a pity that the best illustrations are taken up with such examples as, "Large Air Jar," "Small Air Jar," "Measuring Flasks," "Solution and Pipettes," etc. The object of introducing these is hardly evident.

It is to be hoped that in a future edition necessary corrections and alterations will be made, and the book will then become much more useful for those for whom it is intended. A. B. H.

CREMATORIA IN GREAT BRITAIN AND ABROAD.*

The incineration of dead bodies is, upon most grounds, the best way of disposing of them; and although the method has appealed more strongly to some other countries than to our own, doubtless the near future is destined to witness a considerable extension of the practice of cremation in this country.

This book may safely be consulted by those concerned with the practical application of this method, the most sanitary of all, for disposing of the dead. Mr. Freeman's work gives a concise description of many crematoria; the fundamental principles of planning crematoria and columbaria; and a general account of the design and construction of the crematory furnaces in operation.

The very large amount of information imparted is well arranged, lucidly expressed, and copiously illustrated by twenty-nine full-page illustrations and many others in the text. H. R. K.

MEETINGS HELD.

Leicester.—The Meeting was held in the Council Chamber on March 24th, 1906, when a discussion on "Cremation," with particulars of the Leicester Corporation Crematorium, was opened by C. Killick Millard, M.D., D.Sc., M.O.H. The chair was taken by Col. J. Lane Notter, M.A., M.D. A visit was made to the Corporation Crematorium.

EXAMINATIONS.

Sanitary Science as applied to Buildings and Public Works.

Birmingham. March 9 and 10. 3 Candidates; 2 Certificates granted.
Sydney. December 21 and 22. 2 Candidates. 2 Certificates granted.

Inspectors of Nuisances.

Sydney. December 21 and 22. 7 Candidates. 4 Certificates granted.
Birmingham. March 9 and 10. 36 Candidates; 15 Certificates granted.
Brisbane. December 12 and 14. 5 Candidates. 5 Certificates granted.

Inspectors of Meat and Other Foods.

Sheffield. March 16 and 17. 10 Candidates. 5 Certificates granted.

Hygiene in its Bearing on School Life.

Blackburn. March 2 and 3. 17 Candidates; 8 Certificates granted.
Birmingham. March 9 and 10. 8 Candidates. 8 Certificates granted.

* Crematoria in Great Britain and Abroad, by Albert C. Freeman. London: St. Bride's Press, Ltd. 35 pp.

Candidates who have received Certificates.

In Sanitary Science as applied to Buildings and Public Works.

Gundry, William Edward.
Haynes, Charles Thomas.
Longland. Frank.
Turner, William.

Inspectors of Nuisances.

Arnold, William Kingsworth.
Bowden. John Philpott Curran.
Brownell, Edward.
Burton, Edwin Horatio.
Clifford, Charles William.
Dean, George Thirlby.
Dudley, Stephen.
Feather, George.
Lewis, Alfred Joseph.
Ludlam, Cuthbert Aubrey Neynor.
McCook, Frank.
McKenzie, Alfred Sheath.
Marlow, George Essex.
Morrison, Marianne Sapcote.
Potter, Albert William.
Russell, Thomas Pearce.
Schofield, Percival.
Thompson, James.
Vickers, Alice.
Wallis, Samuel.
Walter, Julius Ludwig.
Wells, Annie R.
Whatley, Walter.
Wilmot, Samuel.

Inspectors of Meat and Other Foods.

Allison, Richard.
Bennett, Arthur.
Marfell, Thomas Henry.
Rusby, Sam Stephenson.
Saxton, Joseph.

Hygiene in its Bearing on School Life.

Bishop-Ackerman, Daisy Ethel.
Cannan, Margaret Kennedy.
Fraser, Mary Campbell.
Gamlen, Hilda Mary.
Gedge, Constance Elizabeth.
Gibbons, Nora Blanche.
Grandin. Violet Anne.
Warner, Joceyln.
Fawcett, Edith Mary.
Heald, Walter.
Kenyon, Lydia Alice.
Lancaster, Alice Maud.
Maxwell, Jane Carus.
Moffatt, Mabel Paget.
Robinson, Minnie Sherbourne.
Williams, Owen Henry.

FORTHCOMING MEETINGS.

Sessional Meetings.

London, April 27th. Discussion on "The Consumptive at Home," to be opened by G. A. Heron, M.D., D.P.H., F.R.C.P.

Bournemouth, May 26th. Discussion on "Sanitary Administration in a Health Resort," to be opened by Philip W. G. Nunn, L.R.C.P., M.R.C.S., M.O.H.

Annual Dinner.

His Grace the Duke of Northumberland, K.G., President of the Institute, has consented to take the chair at the Annual Dinner of the Institute, which will be held on Wednesday, May 9th, at the Langham Hotel.

CONGRESS, 1906.

The Meeting will be held in Bristol from July 9th to 14th, and the preliminary arrangements are as follows:—

President of the Congress—
THE RT. HON. SIR EDWARD FRY, P.C., B.A., D.C.L., LL.D., F.R.S., F.S.A., F.L.S.

Vice-President—
THE RT. HON. THE LORD MAYOR OF BRISTOL.

Chairman of Local Committee—
Councillor COLSTON WINTLE, M.R.C.S.

Vice-Chairman of Local Committee—
ALDERMAN E. PEARSON.

Hon. Treasurer—
Councillor C. H. CAVE, J.P.

Honorary Local Secretary—
T. J. MOSS FLOWER, A.M.INST.C.E., F.G.S.

Section I. Sanitary Science and Preventive Medicine.
President—SIR WM. J. COLLINS, M.D., F.R.C.S., B.Sc., D.P.H., J.P., M.P.
Hon. Local Secretaries—NEWMAN NEILD, M.B.; J. R. CHARLES, M.D.

„ II. Engineering and Architecture.
President—EDWIN T. HALL, V-P.R.I.B.A.
Hon. Local Secretaries—NICHOLAS WATTS, A.M.INST.C.E.; W. S. SKINNER.

„ III. Physics, Chemistry, and Biology.
President—W. N. SHAW, M.A., D.Sc., F.R.S.
Hon. Local Secretaries—A. M. TYNDALE, B.Sc.; PROF. F. FRANCIS, D.Sc., F.I.C.

CONFERENCES.

Municipal Representatives.
President—Counc. COLSTON WINTLE, M.R.C.S., *Chairman, Health Committee, Bristol.*
Hon. Local Secretaries—EDMUND J. TAYLOR, Town Clerk; W. H. WISE.

Medical Officers of Health.
President—D. S. DAVIES, M.D., D.P.H., *Medical Officer of Health, Bristol.*
Hon. Local Secretaries—J. C. HEAVEN, L.R.C.P.,; J. HOWARD JONES, M.D.

Engineers and Surveyors to Municipal Authorities.
President—H. PERCY BOULNOIS, M.Inst.C.E.
Hon. Local Secretaries—T. H. YABBICOM, M.INST.C.E.; A. P. I. COTTERELL, M.INST.C.E.

Veterinary Inspectors.
President—FRANK LEIGH, F.R.C.V.S.
Hon. Local Secretaries—W. J. CADE, M.R.C.V.S.; GEO. BISHOP, M.R.C.V.S.

Sanitary Inspectors.
President—A. E. HUDSON, *Chief Sanitary Inspector, Cheltenham.*
Hon. Local Secretaries—W. A. CRAVEN; J. W. KIRLEY.

Women on Hygiene.
President—HER GRACE THE DUCHESS OF BEAUFORT.
Hon. Local Secretaries—MISS MARGARET TUKE, M.A.; MISS F. MARION TOWNSEND; MISS M. J. FORTEY.

The Hygiene of School Life.
President—THE LORD BISHOP OF HEREFORD.
Hon. Local Secretaries—WM. AVERY ADAMS; T. S. FOSTER, M.A.

Lecture to the Congress,
by Prof. C. Lloyd Morgan, LL.D., F.R.S.

Popular Lecture,
by Councillor W. F. Anderson, J.P., *Chairman of the Glasgow Health Committee.*

EXAMINATIONS.

In Sanitary Science as Applied to Buildings and Public Works and for Inspectors of Nuisances—
Liverpool, April 6th and 7th.
Hong Kong, April 18th and 19th.
London, May 4th and 5th.
Edinburgh, May 18th and 19th.
Dublin, May 25th and 26th.

For Inspectors of Meat and other Foods—
London, May 11th and 12th.

In Hygiene in its Bearing on School Life—
London, May 4th and 5th.
Edinburgh, May 18th and 19th.

Calendar, April and May, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

APRIL.

2 M. Lecture to Sanitary Officers at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.
4 W. Inspection and Demonstration at the East London Water Works, Lea Bridge, Clapton, at 3 p.m. Conducted by Mr. Blackburn, Deputy Engineer.
4 W. Lecture to Sanitary Officers at 7 p.m. "Water Supply," by J. E. Worth, M.INST.C.E.
6 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

6 F. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D.
6 F. Lecture to Sanitary Officers at 7 p.m. "Water Composition," by A. Wellesley Harris, M.R.C.S., D.P.H.
6 F. } 7 S. } Examination in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Liverpool.
7 S. Demonstration—Meat Inspectors Course at 2 p.m.
7 S. Inspection and Demonstration at the Sewage Outfall Works, Barking, at about 3 p.m. Conducted by J. E. Worth, M.INST.C.E.
9 M. Lecture to Sanitary Officers at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.
10 T. Lecture to Sanitary Officers at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.
11 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt. Public Health Department, Borough of Islington.
11 W. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D., D.P.H.
11 W. Lecture to Sanitary Officers at 7 p.m. "Scavenging," by J. E. Worth, M.INST.C.E.
13 F. } 16 M. } **Easter Holidays.** Library and Museum closed.
18 W. } 19 Th. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Hong Kong.
19 Th. Lecture to Sanitary Officers at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.
20 F. Lecture to Sanitary Officers at 7 p.m. "Signs of Health and Disease in Animals destined for food, when alive and after slaughter. Tuberculin and other Tests," by W. Hunting, F.R.C.V.S.
21 S. Demonstration—Meat Inspectors Course at 2 p.m.
23 M. Lecture to Sanitary Officers at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by W. Hunting, F.R.C.V.S.
24 T. Lecture to Sanitary Officers at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by W. Hunting, M.R.C.V.S.
25 W. Inspection and Demonstration at the East London Soap Works, at 3 p.m. Arranged by Messrs. E. Cook & Co., Ltd.
25 W. Lecture to Sanitary Officers at 7 p.m. "The Appearance and Character of Fresh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods," by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
25 W. **Ordinary General Meeting** at 4.30 p.m.
26 Th. Lecture to Sanitary Officers at 7 p.m. The Hygiene of Byres, Liars, Cowsheds, and Slaughterhouses, and all places where animals destined for the supply of food are kept, and the Hygiene of Markets, Dairies, and other places where food is stored, prepared, or exposed for sale, and transported, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
26 Th. Inspection and Demonstration at the Metropolitan Cattle Market at 2 p.m. Conducted by James King, M.R.C.V.S.
26 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on Tinned and Potted Foods, by Prof. H. R. Kenwood, M.B., D.P.H.
27 F. **Sessional Meeting,** at 5 p.m., London. Discussion on "The Consumptive at Home," to be opened by G. A. Heron, M.D., D.P.H., F.R.C.P.
27 F. Lecture to Sanitary Officers at 7 p.m. The Laws, By-laws, and Regulations affecting the inspection and sale of Meat and other articles of Food, including their preparation and adulteration, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
27 F. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Milk, Butter, Cheese, &c., by Prof. H. R. Kenwood, M.B., D.P.H.
28 S. Demonstration—Meat Inspectors Course at 2 p.m.
28 S. Demonstration to Commissioned Officers and Professional Men, at 3 p.m.
30 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa, Chocolate, Lime Juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

MAY.

1 T. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

2 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

2 W. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

3 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Demonstration to Commissioned Officers and Professional Men at a Factory for preparation of Concentrated and Preserved Foods.

4 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

4 F. } 5 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, London.

9 W. **Annual Dinner of the Institute,** at the Langham Hotel, Portland Place. The President of the Institute, His Grace The Duke of Northumberland, will take the chair at 7.30 p.m.

11 F. } 12 S. } Examination for Inspectors of Meat and other Foods, London.

18 F. } 19 S. } Examination in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Edinburgh.

25 F. } 26 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Dublin.

26 S. **Sessional Meeting,** at 11 a.m., Bournemouth. Discussion on "Sanitary Administration in a Health Resort," to be opened by Philip W. G. Nunn, L.R.C.P., M.R.C.S., M.O.H.

JULY.

9–21 **Congress and Exhibition, Bristol.**

LIST OF MEMBERS AND ASSOCIATES

Elected March, 1906.

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

Reg. No.	Date of Election.	
2052	1906. Mar.	Beaudry, Joseph Antoine, M.A., M.D., *Chief Medical Inspector of the Board of Health of the Province of Quebec, Montreal, Canada.*
2053	1906. Mar.	Dealy, Thomas Kirkman, F.R.G.S., *Craigmin East, Magazine Gap, Hong Kong.*
2054	1906. Mar.	Dennis, Nelson F., A.M.INST.C.E., *Borough Engineer, West Hartlepool.*
2055	1906. Mar.	Douglas, Frederick C., M.D., C.M., D.P.H., 51, *Park Avenue, Montreal, Canada.*
2056	1906. Mar.	Gray, Henry R., *Pharmaceutical Chemist, Montreal, Canada.*

2057 1906. Mar. HEWLETT, Prof., Richard Tanner, M.D., D.P.H., *Director of Public Health Laboratories, King's College, W.C.*
2058 1906. Mar. JANES, Walter Joseph, P.A.S.I., 8, *Thrale Road, Streatham, S.W.*
2059 1906. Mar. JOHNSTON, Alexander, M.D., C.M., D.P.H., *Ruchill Hospital, Glasgow.*
2060 1906. Mar. LACHAPELLE, E. P., M.D., *President of Provincial Board of Health, Montreal, Canada.*
2061 1906. Mar. LACKLAND, John James, ASSOC.M.INST.C.E., *Water Engineer, Town Hall, St. Helens.*
2062 1906. Mar. LEA, R. S., B.A.(SC.), ASSOC.M.INST.C.E., *Consulting Engineer, Provincial Board of Health, Montreal, Canada.*
2063 1906. Mar. LUNDIE, John Alexander, B.A., M.D., C.M., D.P.H., 36, *Fort Street, Montreal, Canada.*
2064 1906. Mar. MOULDING, Thomas, A.M.INST.C.E., *City Engineer and Surveyor, Exeter, Devon.*
2065 1906. Mar. PELLETIER, Elzéar, M.D., *Secretary, Provincial Board of Health, Montreal, Canada.*
2066 1906. Mar. POWELL, Herbert James Bingham, A.M.INST.C.E., *El H Concejo, Provincial de Lima, Peru.*
2067 1906. Mar. REVILL, John F., *Fern-Dene, Richmond Road, Leytonstone.*
2068 1906. Mar. SCANE, John W., M.D., C.M., *Montreal, Canada.*
2069 1906. Mar. TURNER, Herbert John Chater, F.G.S., *c/o Grindlay, Groom & Co., Bombay.*
2070 1906. Mar. *MILLAR, David, 133, *Jamieson Street, Glasgow.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

3802 1906. Mar. ‡AINLEY, Albert, 11, *Thorncliffe Street, Lindley, Huddersfield.*
3803 1906. Mar. ‡BELL, William G., 8, *King Gardens, Plymouth.*
3804 1906. Mar. *s* BOX, Miss Mary Blanche, *South Benfleet Vicarage, Essex.*
3805 1906. Mar. ‡COOPER, J. A. K., *Sanitary Inspector, Town Hall, Catford, S.E.*
3806 1906. Mar. ‡CRISP, Henry Robert, 26, *Green Avenue, W. Ealing.*
3807 1906. Mar. ‡CROSSLEY, Herbert, 6, *Hurst Street, Oldham.*
3808 1906. Mar. *s* CURWEN, Miss Irene, 33, *Buckingham Mansions, W. Hampstead.*
3809 1906. Mar. ‡DUNCAN, James, *Sornhill, Galston, Ayr, N.B.*
3810 1906. Mar. ‡GIDLEY, Hubert John William, *Sanitary Inspector, Victoria, Hong Kong.*
3811 1906. Mar. ‡GREIG, Thomas, 15, *Pumpherston, Mid-Calder, Midlothian.*
3812 1906. Mar. *s* GRIESS, Miss Katherine Elizabeth, 82, *Vincent Square, Westminster, S.W.*
3813 1906. Mar. HUTCHINGS, William James, 252, *Albert Road, Peckham, S.E.*

3314 1906. Mar. ‡Johns, Frank, *Foreman of Works, Calabar, S. Nigeria.*
3315 1906. Mar. ‡Matthews, Samuel, 30, *Grimshaw Lane, Middleton Junction, Lancs.*
3316 1906. Mar. ‡McDowell, William Hemphill, *Clyde House, Ballsbridge, Dublin.*
3317 1906. Mar. ‡McKinnon, Hugh, 11, *Bridge Street, Rothesay, N.B.*
3318 1906. Mar. *s* Moynihan, Miss Emily Groves, 27, *Grove Road, Regent's Park, N.W.*
3319 1906. Mar. ‡Naughton, Harold Francis, "*Coolavin,*" *Roehampton.*
3320 1906. Mar. ‡Smith, James, *Police Station House, Radnor Park, Glasgow.*
3321 1906. Mar. ‡Thorley, John, 49, *Crescent Road, Chorlton-cum-Hardy.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

London. *The Institution of Mechanical Engineers.* Proceedings, June, 1905. Belgian Meeting. 383 pp., 8vo. London, 1906. *The Institution.*

Ascher, *Dr. Louis.* Der Einfluss des Rauches auf die Atmungsorgane. 66 pp., 8vo. Stuttgart, 1905. *The Author.*

Board of Agriculture and Fisheries. Agricultural Returns, 1905 (Produce of Crops). Tables showing the total produce and yield per acre of the principal crops in each county of Great Britain, with summaries for the United Kingdom. 37 pp., 8vo. London, 1906. *The Board.*

Board of Education. Suggestions for the consideration of Teachers and others concerned in the work of Public Elementary Schools. 155 pp., 8vo. London, 1905. *Purchased.*

Bristol. *University College.* Calendar for the Session 1905–6. 361 pp., 8vo. Bristol, 1905. *The College.*

Budapest. Székes Főváros Statisztikai Évkönyve VI. Evfolyam 1903. 301 pp., 4to. Budapest, 1905. *Dr. T. Gusztáv.*

——— Székesfőváros Halandósága az 1901–1905. Evekben és annak okul, irta Dr. Körösy József, 11-ik (Táblás) Rész, 4-ik Füzet, 1904. 75 pp., 8vo. Budapest, 1905. *Dr. Joseph de Körösy.*

Crichton-Browne, *Sir James, M.D., LL.D., F.R.S.* The Prevention of Senility, and a Sanitary Outlook. 141 pp., 8vo. London, 1905. *The Publishers (Macmillan & Co., Ltd.)*

Evans, *E.* The Student's Hygiene. Adapted to the Syllabus of the Board of Education. Stage I., 1905. 309 pp., 8vo. London, 1906. *Swan, Sonnenschein & Co., Ltd.*

Factories and Workshops. Annual Report of the Chief Inspector for the Year 1904. Part II. Statistics. 58 pp., fcp. London, 1906. *A. Whitelegge, C.B., M.D., B.Sc.*

Freeman, *A. C.*, *M.S.A.* Crematoria in Great Britain and Abroad. 35 pp., 4to. London, 1905. *The Publishers (St. Bride's Press, Ltd.)*

Hall, *H. S.*, *M.A.* A Short Introduction to Graphical Algebra. Third Edition. 56 pp., 8vo. London, 1905. *Purchased.*

Hoylake and West Kirby U.D.C. Meteorological Report and Results of Observations for the Year 1905, by Tom Robinson, M.R.San.I. 8vo. Hoylake, 1900. *T. Robinson.*

Lima. Reports on the Drainage and Water Supply of Lima, 1903. 8vo. Lima, 1905. *H. J. Bingham Powell, A.M.Inst.C.E.*

Local Government Board. Preliminary Report on a new Plague Prophylactic, by Dr. Klein, F.R.S. 5 pp., fcap. London, 1906.

——— Dr. Reginald Farrar's Report on the Sanitary Circumstances and Administration of the Clun Rural District, Salop. 8 pp., fcap. London, 1905.

——— Dr. L. W. Darra Mair's Report on the General Sanitary Circumstances and Administration of the Rural District of Sleaford. 16 pp., fcp. London, 1906. *W. H. Power, C.B., F.R.S.*

London County Council. Report of the Education Committee, submitting the Report of the Medical Officer (Education) for the year ended 31st March, 1905. 60 pp., fcap. London, 1905. *James Kerr, M.D., D.P.H.*

——— Report by the Medical Officer, presenting Joint Report by Drs. Klein, Houston, and Gordon on the result of their experiments in connection with the subject of Disinfection. 14 pp., fcap. London, 1902.

——— Report of the Public Health Committee, submitting the Report of the Medical Officer of Health of the County for the year 1904. 178 pp., fcap. *Sir Shirley F. Murphy, M.O.H.*

London. St. Thomas's Hospital Reports. Volume XXXIII. (1904). 486 pp., 8vo. London, 1905. *The Hospital.*

——— The Guinness' Trust. Sixteenth Annual Report for the Year 1905. 3 pp., fcp. London, 1906. *The Trust.*

——— Minutes of Evidence taken before the Inter-Departmental Committee on Medical Inspection and Feeding of Children attending Public Elementary Schools. Vol. II. List of Witnesses, Minutes of Evidence, Appendices, and Index. 362 pp., fcp. London, 1905. *Purchased.*

Marriott, *W.*, *F.R.Met.Soc.* Hints to Meteorological Observers. Prepared under the Direction of the Council of the Royal Meteorological Society. Sixth Edition. 69 pp., 8vo. London, 1906. *The Publisher (E. Stanford).*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, December, 1905; January, 1906 .. .. *Matthew Hay, M.D.*
Berkshire C.C., 1904 .. .. *G. C. Taylor, M.A., M.D., D.P.H.*
Huddersfield, 1905 .. .. .. *S. G. Moore, M.D., D.P.H.*
Johannesburg (Town Engineer's), 1905 *G. S. Burt Andrews.*
Kincardineshire C.C., 1905 .. .. *W. A. Macnaughton, M.A., M.D., D.P.H.*
London (City of), Nov. 18th, 1905—
Jan. 13th & Feb. 17th, 1906 .. *W. Collingridge, M.D., D.P.H.*

Nottingham (Meteorology), 1905 .. *A. Browne, M.Inst.C.E.*
Rothwell, 1905 .. .. .. *R. Stevenson, L.R.C.P.*
St. Thomas, 1905 . .. .. *M. Farrant. M.R.C.S., D.P.H.*
Sutton Coldfield, 1905 .. .. *A. Bostock Hill. M.Sc., M.D., D.P.H.*
West Bromwich, 1905 .. .. *H. Manley, M.A., M.D., D.P.H.*

Metropolitan Water Board. Report on the Results of the Chemical and Bacteriological Examination of the London Waters for the month ending Nov. 30th, 1905, by Dr. Houston, Director of Water Examinations. Nos. 1 & 2. 95 pp., fcp. London, 1906. *The Board.*

Michigan. Thirty-first Annual Report of the Secretary of the State Board of Health, for the Year ending June 30th, 1903. 262 pp., 8vo. Lansing, 1904. *The Board.*

New South Wales. Report of the Board of Health on Leprosy for the year 1904. 15 pp., fcap. Sydney, 1905. *J. Ashburton Thompson, M.D., D.P.H.*

Ontario. The Sanitary Journal of the Provincial Board of Health, Parts II. and III. of the Twenty-fourth Annual Report, being for the Year 1905, 161 pp., 8vo. Toronto, 1905. *The Board.*

Ottawa. *Laboratory of the Inland Revenue Department.* Bulletin No. 110. Tincture of Ginger; No. 111, Olive Oil; No. 112, Highly-coloured Confectionery. 37 pp., 8vo. Ottawa, 1906. *W. J. Gerald.*

Paris. Notice sur la dérivation des sources du Loing et du Lunain, par MM, Bechmann et Babinet. 164 pp. (plates), 8vo. Paris, 1905. *G. Bechmann.*

Registrar-General. Sixty-sixth Annual Report of the Births, Deaths, and Marriages in England and Wales (1903). 329 pp., 8vo. London, 1905.

——— Forty-ninth Annual Report of Births, Deaths, and Marriages in Scotland. (Abstracts for 1903.) 571 pp., 8vo. Glasgow, 1906.

——— Supplement to the Forty-eighth Detailed Annual Report of Births, Deaths, and Marriages in Scotland. 169 pp., 8vo. Glasgow, 1905. *The Registrar-General.*

Russell, *J. B., B.A., M.D., LL.D.* Public Health Administration in Glasgow. (A Memorial Volume of the writings of.) Edited by A. K. Chalmers, M.D. 612 pp., 8vo. Glasgow, 1905. *The Publishers (J. MacLehose & Sons).*

West Riding of Yorkshire. Report of the County Medical Officer with regard to Isolation Hospital Accommodation. 12 pp., fcp. Wakefield, 1906. *J. R. Kaye, M.B., D.P.H.*

LIST OF EXHIBITS ADDED TO THE MUSEUM.

Water Closet. Half-size, half-section, Waverley Pattern Washdown w.c., with ventilating arm. *Doulton & Co., Lambeth.*

Accident and Fire-resisting Glass, prepared on interwoven wire. Pilkington's pattern. *H. H. Palmer, 222, Strand.*

Drains. Winser's Intercepting Trap, glazed stoneware, with B.P. stopper fitted into cleansing arm. *Knowles & Co., St. Pancras.*

GENERAL NOTES.

The Second International Congress of Assainissement et Salubrité de L'habitation, under the auspices of the French and Swiss Societies of Hygiene, will be held in Geneva at the end of August, 1906.

The object of the Congress is to discuss the Sanitary construction and arrangements of dwellings and buildings.

The meeting will be divided into eight sections:—

(i) Town houses.
(ii) Country houses.
(iii) Workmen's dwellings.
(iv) School buildings, lodging houses, hotels, furnished apartments.
(v) Military dwellings.
(vi) Art in connection with the habitation.
(vii) Railways, tramways, omnibusses, carriages, canal boats, and ship buildings.
(viii) Legislation and Statistics.

Particulars with regard to tickets, programme of proceedings (receptions, banquet, excursions on the lake, etc.), can be obtained from M. F. Marié Davy, Secretaire général, Rue Brezin, Paris.

The President of the Institute, His Grace the Duke of Northumberland, has consented to act as a Vice-President and two Delegates have been appointed to represent the Institute at the meeting.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	38	10	6

Contributions since last report.

	£	s.	d.
F. Allen (2nd donation)	1	0	0
J. G. Bateman		10	6
W. G. J. Clark ... ... during two years	1	1	0
F. T. Deverill		10	6
The Worshipful Company of Drapers	50	0	0
Dr. Herbert Jones ... ... during five years	5	5	0
F. W. Miller		10	6
Dr. J. G. Victor Sapp	2	2	0
Other Amounts		2	0

March 26th, 1906.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

SANITARY ENGINEERING.*

The author says, in the Preface, that "The greatest care has been exercised to construct recognised formulæ *ab initio* and in the simplest stages, only the most elementary knowledge of the different branches of mathematics being required"; but as he gets into the calculus and trigonometry at page 13, his efforts at elucidation will hardly appeal to the sanitary inspectors, for whom, amongst others, he avowedly caters. It would have been more advantageous if he had simply stated the formulæ and then have shown how to use them, leaving the student to refer to the original in Rankine's works. From a practical man one expects practical assistance, and the absence of this is most marked in those parts where the explanations are most prominent, as, for instance, in connection with retaining walls and tall chimneys. Some of his definitions show a variation from standard works; Ordnance Datum is "the level of the old dock sill at Liverpool"; the specific gravity of any substance "is measured by the weight of a unit volume of that substance." Some of his general statements are peculiar. Under the head of sewer ventilation he says, "Soil pipes only should be ventilated, as these may occasionally be relied upon to supply air to the sewers by the body of water which is so suddenly emptied into them from the water-closets." And again, "The author is convinced that the erection of ventilating pipes in the ordinary way does not serve the purpose in the slightest degree; the shaft will not, in most cases, ventilate itself: often enough the air is merely oscillating in the pipe." He also advocates six inches as the least diameter of soil drains. In describing some grease traps he says, "In these traps the grease cools, and may be taken out and boiled in order to remove all water; it may then be used for many economical purposes." Here is apparently a new line for the thrifty housewife; but it must evidently be read in connection with a statement on the next page, that "Hotels and manufactories now recognise the value of the grease, and collect it for its commercial value."

Having pointed out some of the shortcomings of the book, it is only fair to add that there is a large amount of useful information to be obtained from its pages. In Chapter VI., on House Drainage, a *résumé* is given of cases which have been decided upon the question of "drain or sewer," showing that the law is at present in a hopeless muddle. There are many good illustrations of sanitary appliances, and under the head of Sewage Disposal all the principal methods that have been used are briefly described. H. A.

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* Sanitary Engineering: a Practical Manual of Town Drainage and Sewage and Refuse Disposal, for Sanitary Authorities, Engineers, Inspectors, Architects, Contractors, and Students. By Francis Wood, M.Inst.C.E., F.G.S., Borough Surveyor of Fulham, late Borough Engineer, Bacup, Lancs.; with numerous Illustrations. Second Edition. London: Charles Griffin & Co., Ltd., 1906.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in relation to Hygiene and Preventive Medicine.

FORSTER, W. H. C., M.B., C.M., D.P.H. Malta Fever in India: Isolation of the *Micrococcus melitensis* from the Milk of a Domestic Goat in the Punjab. *Lancet*, 17th Feb., 1906, p. 441.

KOSSEL, Prof. Dr. H. Human and Bovine Tuberculosis. *British Medical Journal*, 2nd Dec., 1905, p. 1445.

Report of a paper read at the Paris Congress on Tuberculosis, 1905.

OGILVIE, GEO., B.Sc., M.B. The Descendants of the Tuberculous and Hereditary Predisposition. *Lancet*, 2nd Dec., 1905, p. 1611.

The question of heredity in relation to tubercular disease is discussed.

ROYAL SOCIETY. Reports of the Commission for the Investigation of Mediterranean Fever. 8vo. London.

Part I., 1905. Six papers on *Micrococcus melitensis*, with one report of experimental work.

Part II., 1905. Report on the general sanitary circumstances of the Maltese Islands, by Dr. R. W. JOHNSTONE, and two papers on *M. melitensis*.

Part III., 1905. Four papers on *M. melitensis*, and five others on various subjects connected with the disease.

Part IV., 1906. Fourteen papers, the chief one by Lt.-Col. A. M. DAVIES, being a report on the prevalence of Mediterranean fever among British troops in Malta, 1905. This gives a full description of the sanitary condition of the various barracks, hospitals, and married quarters; statistics of the incidence of the disease in these places and also amongst the different regiments, etc. (the R.A.M.C. having the highest attack-ration) as well as amongst women and children. The conditions as to water, food, milk, air, and sanitary appliances are gone into, but they are not found on the whole to have formed channels of infection, transmission by semi-direct contagion or through mosquitoes seems most probable. Various recommendations for the sanitary improvement of the barracks, etc., are made.

TREVELYAN, E. F., M.D., B.Sc.Lond. The Institution and Sanatorium Treatment of Pulmonary Tuberculosis in relation to Large Centres of Population. *Lancet*, 27th Jan., 1906, p. 205.

MEETINGS HELD.

London.—The Meeting was held in the Parkes Museum on Friday, April 27th, 1906, when a discussion on "The Consumptive at Home" was opened by G. A. Heron, M.D., D.P.H., C.M., F.R.C.P. The chair was taken by A. C. Scovell, J.P., Chairman of the Metropolitan Asylums Board.

On Saturday. the 28th, a visit was made to the Mount Vernon Hospital, Hampstead, and the Members were afterwards entertained at tea at Upper Frognal Lodge.

Examinations.

Sanitary Science as applied to Buildings and Public Works.

Liverpool. April 6 and 7. 1 Candidate. No Certificate granted.

Inspectors of Nuisances.

Liverpool. April 6 and 7. 39 Candidates. 15 Certificates granted.

Hygiene in its Bearing on School Life.

Liverpool. April 6 and 7. 1 Candidate. No Certificate granted.

Candidates who have received Certificates.

Inspectors of Nuisances.

Allen, Harold George.
Brown, Albert Bentley.
Cargill, Albert Charles.
Carter, Samuel James.
Clapham, Harry.
Grey, David.
Groom, Frank Arthur.
Hulton, Wm. Ankers.
Jardine, Robert.
Llewellyn, Daniel.
Lucas, Charles Wilfred.
Monk, John Henry.
Shannon, John Paterson.
Swann, Esther.
Walker, John William.

FORTHCOMING MEETINGS.

Sessional Meetings.

Bournemouth, May 26th. Discussion on "Sanitary Administration in a Health Resort," to be opened by Philip W. G. Nunn, L.R.C.P., M.R.C.S., M.O.H.

Derby, June 29th. Discussion on "Milk Sterilising."

Annual Dinner.

His Grace the Duke of Northumberland, K.G., President of the Institute, has consented to take the chair at the Annual Dinner of the Institute, which will be held on Wednesday, May 9th, at the Langham Hotel.

CONGRESS, 1906.

The following Set Subjects have been arranged for discussion in:—

Section I. Sanitary Science and Preventive Medicine.

"An International System of the Notification of the more serious Infectious Diseases," to be introduced by E. WALFORD, M.D., D.P.H.

" II. Engineering and Architecture.

"The Construction of Isolated Homes for the aged poor *versus* the Workhouse," to be introduced by A. SAXON SNELL, F.R.I.B.A.

" III. Physics, Chemistry, and Biology.

"The Influence of Dust on Health," to be introduced by PHILIP BOOBBYER, M.D.

Conference of Municipal Representatives.

"The Rational Extension of Modern Cities," to be introduced by ARTHUR RICHARDSON, M.P.

Conference of Engineers and Surveyors.

"Rural Road Construction and Maintenance," to be introduced by R. PHILLIPS, M.INST.C.E.

Conference of Medical Officers of Health.

"Amendment of Existing Laws and the need of additional powers for greater efficiency in Public Health Administration."

Conference of Veterinary Inspectors.

"Milk Contamination in Collection and Transit," to be introduced by J. S. LLOYD, F.R.C.V.S.

Conference of Sanitary Inspectors.

"Advantages of Public Abattoirs," to be introduced by GEO. ANDERSON.

Conference of Women on Hygiene.

"Free Meals for Nursing Mothers," to be introduced by Miss EDITH EVANS.

Conference on the Hygiene of School Life.

"Instruction and Hygiene in Training Colleges," to be introduced by Miss ALICE RAVENHILL.

Up to the present 122 Authorities have appointed 243 Delegates to the Meeting, and a large number of Members have applied for Tickets.

EXAMINATIONS.

In Sanitary Science as Applied to Buildings and Public Works and for Inspectors of Nuisances—

London, May 4th and 5th.
Edinburgh, May 18th and 19th.
Dublin, May 25th and 26th.

For Inspectors of Meat and other Foods—

London, May 11th and 12th.

In Hygiene in its Bearing on School Life—

London, May 4th and 5th.
Edinburgh, May 18th and 19th.

Calendar, May and June, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

MAY.

1 T. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

2 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

2 W. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

3 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Demonstration to Commissioned Officers and Professional Men at a Factory for preparation of Concentrated and Preserved Foods.

4 F. Demonstration—Meat Inspectors Course at 6.30 p.m.

4 F., 5 S. Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, London.

5 S. Demonstration to Commissioned Officers and Professional Men, at the Metropolitan Cattle Market, at 3 p.m., conducted by James King, M.R.C.V.S.

9 W. **Annual Dinner of the Institute,** at the Langham Hotel, Portland Place, The President of the Institute, His Grace The Duke of Northumberland, will take the chair at 7.30 p.m.

11 F., 12 S. Examination for Inspectors of Meat and other Foods, London.

18 F., 19 S. Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and on Hygiene in its bearing on School Life, Edinburgh.

25 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, and
26 S. } for Inspectors of Nuisances, Dublin.

26 S. **Sessional Meeting**, at 11 a.m., BOURNEMOUTH. Discussion on "Sanitary Administration in a Health Resort," to be opened by Philip W. G. Nunn, L.R.C.P., M.R.C.S., M.O.H.

JUNE.

1 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, for
2 S. } Inspectors of Nuisances. and in Hygiene in its bearing on School Life, York.

15 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, for
16 S. } Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Leeds.

22 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, for
23 S. } Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Manchester.

29 F. **Sessional Meeting**, at 11 a.m., DERBY. Discussion on "Milk Sterilising."

30 S. Visit to the Sewage Works, DERBY.

29 F. } Examination for Inspectors of Meat and other Foods, Liverpool.
30 S. }

JULY.

9–21 **Congress and Exhibition, Bristol.**

LIST OF MEMBERS AND ASSOCIATES

ELECTED APRIL, 1906.

MEMBERS.

* Passed Examination in Sanitary Science as applied to Buildings and Public Works.

2071 1906. Apr. DORÉ, J. E., *City Sanitary Engineer, Montreal, Canada.*

2079 1906. Apr. *FARMER, John Edwin, "*Blelsoe,*" *New Road, Mitcham, Surrey.*

2072 1906. Apr. GETTINGS, Sydney S., P.A.S.I., *Assistant Surveyor, Town Hall, West Bromwich.*

2073 1906. Apr. LABERGE, J. E., M.D., D.P.H., *Bacteriologist to the City of Montreal, Quebec.*

2080 1906. Apr. *LONGLAND, Frank, 64, *Commercial Road, Swindon.*

2074 1906. Apr. MARCEAU, Ernest, *Principal, Ecole Polytechnique, Montreal.*

2075 1906. Apr. MELVILLE, Lieut.-Col. Charles H., R.A.M.C., M.B., C.M., D.P.H., *Wokingham, Berks.*

2076 1906. Apr. MODI, Edalji Manekji, F.G.S., F.S.S., F.R.MET.S., *Grant Road Station, Sleater Road, Bombay, India.*

2077 1906. Apr. RYMAN, Frederick Robert, ASSOC.M.INST.C.E., *Borough Surveyor and Engineer, Stamford, Lincolnshire.*

2078 1906. Apr. SILLITOE, William C., ASSOC.M.INST.C.E., *Town Hall, Ealing, W.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
***S* Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.**

3924 1906. Apr. ‡BAKER, T., *Kean Street, Aldwych, W.C.*
3925 1906. Apr. ‡BOWDEN, John Philpot Curran, 285, *Stapleton Road, Bristol.*
3922 1906. Apr. DRAPER, Thomas Matthew, 102, *Bickley Street, Moss Side, Manchester.*
3926 1906. Apr. *S* HEALD, Walter, "*Fern Bank,*" *Duke's Brow, Blackburn.*
3927 1906. Apr. ‡KILLINGTON, Charlie, *Foreman of Works, H.M. Naval Yard, Wei Hai Wei, N. China.*
3928 1906. Apr. ‡LUDLAM, Cuthbert Aubrey Neynor, 18, *Sinclair Gardens, W. Kensington.*
3929 1906. Apr. ‡MARLOW, George Essex, *Franklyn House, Desborough, Northhants.*
3930 1906. Apr. ‡MONTGOMERY, Hugh, *Comber House, Antrim Road, Green Point, Cape Town, S. Africa.*
3931 1906. Apr. ‡POTTER, Albert William, 10, *Fernbank Road, Redland, Bristol.*
3932 1906. Apr. ‡ROBINSON, Clement Maybury, 3, *Lichfield Grove, Church End, Finchley, N.*
3921 1906. Apr. SMITH, James Isaac, *Council House, Hounslow.*
3933 1906. Apr. ‡VICKERS, Alice, 45, *Sampson Road, Sparbrook, Birmingham.*
3934 1906. Apr. ‡WALLIS, Samuel, 138, *London Road, Kettering, Northants.*
3935 1906. Apr. ‡WHATLEY, Walter, 8, *Crescent Road, Kidderminster, Worcs.*
3936 1906. Apr. ‡WILMOT, Samuel, 2, *Clawson Terrace, Argyle Street, Nottingham.*

LIST OF EXHIBITS ADDED TO MUSEUM.

Lavatory Door Fastening. Model door and frames fitted with Maskelyne's Patent Lock and Apparatus for receiving coins, Attendant's Key to open in case of accident, etc.; Indicating Tablet worked by bolt in the inside of door. *Benham & Froude, Ltd., Store Street.*

Water Elevator. Model of the Safety Water Elevator Apparatus for lifting water from wells, two buckets being used having false bottoms, to be released when they reach the top and discharge contents into trough connected with spout. Ratchet action prevents brackets running back when handle is released. All closed in to avoid contamination.
The Safety Water Elevation Co.

Drain Pipes. Defective, showing junctions and broken joints.
Dr. L. C. Parkes.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	99	12	0

Contributions since last report.

	£	s.	d.
Miss K. E. Ashe		10	6
W. Grellier	5	5	0
John Hall		10	6
Dr. A. Wellesley Harris	5	5	0
J. W. Hetherington		10	6
Dr. James Kerr (2nd donation)	4	4	0
Fitzwilliam Wright		10	6

April 26th, 1906.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

BUILDING CONSTRUCTION.*

It often happens when at work on a drawing, that you want to refer to a point of construction for the moment forgotten. This book of Prof. Adams' is just the sort of work you want to have by you at that time. With an excellent index, clear drawings and descriptions the book contains a good deal of information so often wanted to give points of construction, methods of doing particular kinds of work, or the quality of materials in working out any plan or constructional detail. The size of the book is sufficiently large to enable the illustrations to be clearly drawn without the book taking up half the drawing board, and the information is so clearly given without too great elaboration that the least experienced assistant can be referred to the book without fear that in five minutes' time he will come to you to work out the problem for him.

It is not a book on Building Construction of the ordinary type, but, as the preface states, is a collection of answers that have appeared in reply to questions sent to the professional papers of cases that have arisen in actual practice; and it is believed that this mode of dealing with typical examples of principle and theory, method and practice, process and material, will render the book useful to many besides students.

Prof. Adams' great experience as a Lecturer, combined with his wide range of practical experience as a Consulting Engineer, is a guarantee that the construction given in the book is based on the best modern practice. Of course, in a work of this magnitude, it is easy to point out details that might be improved; the bulk of the illustrations are excellent, but it would be well in those of the sanitary details to redraw some. As a matter of construction the joints between metal and stoneware should not be built into the main walls of the building. The illustration of the wash-down closet is shown with a socket to connect with the soil pipe; this is not usual. In the drainage plan of the house in a terrace it would be better to take the sink drain into a manhole, where the soil pipe connects with the drain, to afford means of access for the removal of grease. As drawn with a Y junction to the drain in the middle of the house, and a double bend on the drain, it would be very difficult to clear the drain in the event of any grease being washed into the pipe.

In the description of the composition of mortar it is stated that one yard of mortar contained 27 cubic feet, and requires 9 bushels of grey lime and 1 yard of sand, with sufficient quantity of water, to bring it to a stiff paste. The bushels must be heaped, and will then hold 1½ cubic feet; so that 9 bushels equals 13½ cubic feet, which disappears in bulk when mixed with the 27 cubic

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* "Building Construction," by Prof. Hy. Adams, M.Inst.C.E. 552 pp., 4to. Cassell & Co. London. Price 7s. 6d.

feet of sand. This piece of information will delight some of the builders, and some surveyors will give a different explanation; but we are not told whether the lime is measured, slacked or unslacked. This is a very important point, which is now a matter of appeal under the London County Council By-laws. In the new edition this mixing and proportion of materials in making mortar might be enlarged.

It would really add to the value of the work if a list of weights of fire-proof floors, various kinds of roofs, &c., were given, as well as the measurements of such things as carriages, motor cars, &c., and the size of motor garages, and pits, and other methods of getting at the machinery of motor cars.

PHYSIOLOGY FOR BEGINNERS.*

This little work is intended for those who, without any previous knowledge of the subject, desire to acquire a knowledge of Elementary Physiology. The chapters are evidently not intended to take the place of larger elementary works, but may be considered rather as furnishing a concise statement of the essential facts connected with the subject to which they refer, and upon which the true principles of sanitary science are based.

The text is clearly written, concise, and amply illustrated. The simple language is a feature which will commend the book to all teachers, and in it the student will find the essential facts concerning the structure and functions of the human body. It is admirably adapted for science schools, and supplies a want which has long been felt. We have much pleasure in bringing to the notice of all teachers of sanitary science subjects the excellent little book under review.

J. L. N.

Dr. F. C. Lewis, the English Referat for the "Hygienisches Centralblatt," has forwarded a copy of this new publication, together with particulars of its objects. The "Hygienisches Centralblatt" will give reviews of works bearing on hygiene by means of short summaries of the original articles.

It will include reports, which a body of International Collaboraters will supply, from every branch of hygiene. The "Centralblatt" will in general deal with the following subjects:—

1. The Atmosphere—the Soil—Climate-Clothing. II. Water Supply—Treatment and Analysis of Drinking-Water. III. Nutrition—Inspection of Meat—Cattle and Meat Markets. IV. General Hygiene of Buildings and Houses. V. Special Hygiene of Buildings. VI. Municipal Cleansing—Sewage—Pollution of Rivers. VII. Methods of Locomotion. VIII. Hygiene of Schools—Sports and Games. IX. Industrial Hygiene. X. Infectious Diseases—Contagious Diseases of Animals—Vaccination—Disinfection. XI. Tropical Hygiene—Tropical Diseases. XII. Military Sanitation. XIII. Social Hygiene. XIV. Vital Statistics. XV. Patients. XVI. Reports of various Hygienic Societies.

The Journal will appear in Twenty-four Parts; these will be issued fortnightly. The price is 30s. per volume.

* "Physiology for Beginners," by Leonard Hill, M.B., F.R.S. 3rd Impression: Edward Arnold, 1905. Price 1s.

THE ROYAL SANITARY INSTITUTE.

ANNUAL REPORT OF THE COUNCIL
FOR THE YEAR 1905.

Read at the Ordinary General Meeting, May 2nd, 1906.

NEW PREMISES.

One of the most important matters that has engaged the attention of the Council during the past year has been the question of providing new premises to suitably accommodate the continually increasing work of the Institute. The special Committee appointed to consider the question of new premises have had before them a large number of sites and buildings suggested as suitable for the purposes of the Institute. In the early part of the year, the Council were granted a six months' option for renting a site in the area of the Westminster Improvement Scheme. Particulars of this proposal were circulated to the Members and Associates of the Institute, and an appeal was made for donations and subscriptions to meet the extra expenditure which would have had to be incurred under the scheme. As the result of this appeal, donations and promises of contributions and subscriptions to the fund were received, amounting to £1,462 12s. 6d. The Council did not, however, feel that the support which had been accorded to the scheme was sufficient to justify them in going forward with it, and the proposal therefore dropped. The Committee still continued their work of considering various suggestions and recommendations brought before them, and as a result of the Committee's efforts, the Council hope shortly to be in a position to lay before the Members a proposal which will promote the best interests of the Institute, and provide the increased accommodation so essential for its rapidly developing work.

The fund for new premises now amounts to £10,167 11s. 6d. In addition to this, promises of donations and annual subscriptions to the fund have been received to the amount of £1,048 4s. 0d.

The Council desire to express their thanks to the public bodies who have so kindly made donations to the New Premises Fund,

including the Corporation of Wigan, and the following City Companies:—

Carpenters' Company.
Clothworkers' Company.
Cordwainers' Company.
Grocers' Company.
Leathersellers' Company.
Mercers' Company.

It is also satisfactory to note the general response made by the Members and Associates to the appeal for funds for New Premises, and although the amount contributed is not very large, it shows a considerable interest on the part of the members in the proposals for adequately housing the Institute and Museum.

ASSOCIATED WORK.

In reviewing the work of the past year, one phase of the Institute's activity and usefulness, which has been increasingly prominent of late, calls for special mention. The Council has on several occasions been applied to by Foreign Governments and by Local Authorities for advice on sanitary questions, or to nominate experts to give professional assistance in Public Health matters; and at the beginning of the year a special sub-Committee was appointed, consisting of representatives of the various professions connected with Sanitary Science, to advise the Chairman when considering such applications. This sub-Committee had several cases submitted to them during 1905, and were able by their advice to render some practical assistance in furtherance of Public Health.

The Institute and the Parkes Museum are frequently visited by official representatives and Commissioners from Foreign Governments, making inquiries with reference to the sanitary service of this country. During the past year, assistance has been given in this way to representatives from Chili, Jamaica, and the Netherlands, and the visitors expressed much interest in the work which the Institute is doing. Applications for advice and assistance have also been received from the Town Council of Accra (Gold Coast) and from Johannesburg, and the help that the Council were able to render in this direction has been gratefully acknowledged.

In the course of the year, permission was granted to several Societies to hold their meetings at the Institute, including—The sub-Committee of the British Association appointed to consider the conditions of health essential to the carrying on of the work of instruction in Schools; the Childhood Society; the King Alfred School Society; and the Women Sanitary Inspectors' Association.

In March, 1904, the first International Congress on School Hygiene was held at Nuremburg. The Institute has for many years taken an interest in this important subject, and by means of courses of training and examinations has endeavoured to secure the preparation of teachers for carrying on the education in schools in accordance with health conditions; and they sent to the Congress in Nuremburg, saying that if the next meeting was held in London, they would be glad to assist in promoting its success, and to arrange for the Exhibition in connection with the Congress. The permanent Committee of the Congress decided to hold their next meeting in London in 1907, and the Council are co-operating with the Organising Committee in making arrangements for the meeting, which, it is anticipated, will be very large and successful. The Council are also undertaking the organisation of an Exhibition of School Apparatus and Appliances in connection with the Congress.

SANITARY LEGISLATION.

The Institute had under consideration the following Bills introduced into Parliament during the year. The action taken by the Council and the fate of the Bill is noted in each case:—

Milk Depots (London) Bill. Presented by Mr. T. Lough, supported by Dr. Shipman, Sir Charles Dilke, Dr. Macnamara, and Mr. J. H. Whitley.

To allow Metropolitan Borough Councils to establish and maintain Milk Depots.

Decided that no action be taken. The Bill was dropped.

Vaccination Bill. Presented by Mr. Stanhope, supported by Mr. Broadhurst, Mr. Channing, Mr. Maurice Levy, and Sir Charles M'Laren.

Provides that proceedings cannot be taken against any person for non-compliance with the provisions of any Vaccination Act, without the sanction of the Board of Guardians or local authority.

Decided to petition against this Bill. The Bill was dropped.

Compulsory Vaccination Bill. Ordered to be brought in by Mr. Broadhurst, Mr. Thomas Bayley, Sir John Rolleston, Mr. Channing, Mr. Corrie Grant, and Mr. Levy.

To abolish Compulsory Vaccination.

Decided to petition against this Bill. The Bill was dropped.

Vaccination (No. 2) Bill. Ordered to be brought in by Mr. Broadhurst. Mr. Thomas Bayley, Sir John Rolleston, Mr. Channing. Mr. Corrie Grant, and Mr. Levy.

Repeals the compulsory clauses of the Vaccination Acts.

Decided to petition against this Bill. The Bill was dropped.

Juvenile Smoking Bill. Presented by Dr. Macnamara, Mr. John Burns, Mr. Winston Churchill, Mr. Crooks, Sir John Gorst, Mr. Lambert, Mr. Lloyd-George, Major Seely, Dr. Shipman, Sir John Tuke, Mr. Cathcart Wason, and Mr. George White.

To prohibit the sale of tobacco and cigarettes to children under the age of 16 years, and to prohibit the sale of tobacco and cigarettes in sweet and other shops frequented by children.

Decided that no action be taken. The Bill was dropped.

Home Industries Bill. Presented by Colonel Denny, supported by Mr. John Burns, Mr. Charles Douglas, Mr. Emmott, Mr. Fenwick, Sir Michael Shaw-Stewart, and Mr. John William Wilson.

Provides that all dwellings in which specified trades or industries are carried on, must be certified as suitable for the purpose, and properly equipped with means of ventilation.

Decided that no action be taken. The Bill was dropped.

Sale of Butter Bill. Presented by Mr. Fellowes, supported by Mr. Gerald Balfour and Mr. Attorney-General.

Restricts the amount of water in butter, and provides for the inspection of butter manufactories.

Decided to petition in favour of this Bill. The Bill was withdrawn.

Housing of the Working Classes Acts Amendment Bill. Ordered to be brought in by Sir Walter Foster, Mr. Channing, Mr. Stevenson, Mr. Price, Mr. Broadhurst, Mr. Frederick Wilson, Mr. Herbert Samuel, and Mr. Soames.

Allows a Rural District Council to adopt Part III. of the Act of 1890 without the leave of the County Council.

Decided that no action be taken, as the Bill did not appear to contain any sanitary provisions. The Bill was dropped.

Housing of the Working Classes, &c., Bill. Presented by Mr. Nannetti, supported by Captain Norton, Mr. Joyce, Mr. Harwood, Mr. Crooks, Mr. Field, Mr. Bell, Sir Fortescue Flannery, Mr. Jacoby, Mr. Keir Hardie, Dr. Farquharson, and Mr. Harrington.

Extends the period for which money may be borrowed by Local Authorities to 100 years, and generally deals with administrative questions.

Decided that no action be taken, as the Bill did not appear to contain any sanitary provisions. The Bill was dropped.

Public Health Acts (Amendment) Bill (House of Lords). Introduced by Lord Hylton.

To exempt buildings sufficiently isolated from the operation of existing and future building By-Laws; to provide against alterations of such exempted buildings; and to render exempted buildings subject to Sanitary By-Laws.

Decided to petition in favour of this Bill. The Bill did not pass the Commons.

Factory and Workshop Act, 1901, *Amendment Bill.* Ordered to be brought in by Mr. Cameron Corbett, Sir Hugh Shaw-Stewart, Mr. Arthur Henderson, and Mr. Trevelyan.

To distribute the working hours in laundries more regularly over the week; to regulate the daily working hours; and to bring within the scope of the Factory Act the laundries of religious and charitable institutions.

Decided to petition in favour of this Bill. The Bill was withdrawn.

Infectious Diseases (Ireland) Bill. Presented by Mr. Long, supported by Mr. Attorney-General for Ireland.

To assimilate the law in Ireland to that in England so far as regards the notification of cases of infectious disease, and the steps to be taken with the view of preventing the spread of such disease through the medium of day schools.

Decided to petition in favour of this Bill. The Bill was withdrawn.

Vaccination Prosecutions Bill. Presented by Mr. Channing, supported by Sir John Rolleston, Mr. Goddard, Mr. Brigg, Mr. Broadhurst, Mr. Corrie Grant, and Mr. Bell.

To provide that no prosecution under the Vaccination Acts shall be commenced without the authority of the Guardians.

Decided to petition against this Bill. The Bill was dropped.

London County Council (General Powers) Bill. Presented by Mr. J. Williams Benn and Mr. Crooks.

To give powers to the London County Council with regard to administration and certain works in the County of London.

Decided to petition against the Bill, as the Council considered that the clauses with regard to milk supply would constitute dual control. The petition was not, however, sent in, as the clauses relating to Milk Supply were withdrawn. The Bill received the Royal Assent.

The Institute were also asked by the London County Council to forward any suggestions they might have to offer with regard to the amendment of the London Building Acts. The matter was carefully considered by the Committee, and a number of suggestions were formulated and sent in to the London County Council.

SESSIONAL MEETINGS.

Meetings were held in London in March, May, June, and November; and during the year in the following towns:—Newcastle-upon-Tyne, Bristol, Liverpool, Birmingham, Cambridge, York, Northampton, and Hastings. The discussions were in most cases arranged in the morning, and demonstration visits were made in the afternoon to Sanitary works relating to the subjects discussed. There was an attendance at the various meetings ranging from 60 to 120.

The Institute is indebted to Dr. H. E. Armstrong, T. J. Moss-Flower, A.M.INST.C.E., Dr. A. A. Mussen, J. T. Eayrs, M.INST.C.E., Dr. Bushell Anningson, Dr. E. M. Smith, Dr. J. Beatty, and P. H. Palmer, M.INST.C.E., who very kindly acted as Local Secretaries and organised these successful meetings.

Hospitality was kindly extended to the Members by Dr. Colston Wintle (Chairman of the Health Committee, Bristol), Cadbury Bros., Bourneville, G. A. St. Croix Rose (Vice-Chairman) and the Committee of the Heatherside Sanatorium of the Brompton Hospital, Prof. G. Sims Woodhead, The Rt. Hon. the Lord Mayor and Lady Mayoress of York, Dr. G. F. McCleary; and the Sanitary Committee of Newcastle-upon-Tyne.

The following subjects were brought forward:—

"The Aerial Dissemination of Smallpox round Hospitals," by H. E. ARMSTRONG, D.HY., M.R.C.S.; Louis Parkes, M.D., D.P.H., in the Chair.

"Municipal Milk Depots and Milk Sterilisation," by G. F. McCleary, M.D., D.P.H.; Sir Shirley F. Murphy in the Chair.

"Isolation Hospitals," by D. S. Davies, M.D., D.P.H., and T. H. Yabbioom, M.INST.C.E.; W. Whitaker, B.A., F.R.S., F.G.S., Chairman of Council, in the Chair.

'Recent Methods of Rehousing Tenants Dispossessed from Insanitary Property," by Fletcher T. Turton; Sir Francis Sharp Powell, Bart., M.P. (Vice-President), in the Chair.

"Housing in Mansions let as Flats," by Louis C. Parkes, M.D., D.P.H., and W. Rolfe; Sir William Emerson, F.R.I.B.A., in the Chair.

"Certain Aspects of the Housing Problem," by J. Robertson, M.D., B.SC.; George Reid, M.D., D.P.H., in the Chair.

"Sanatoria for Consumption: Location and Design," by Edwin T. Hall, V.P.R.I.B.A.; Major-General the Right Hon. Lord Cheylesmore in the Chair.

"The Water Supply Problem in Rural Districts" and "Interpretation of the Reports of Water Analyses," by Prof. G. Sims Woodhead, M.D., F.R.C.P., and J. E. Purvis M.A., F.I.C., F.C.S.; Col. J. Lane Notter, R.A.M.C., Chairman of Council, in the Chair.

"The Boot and Shoe Trade as it affects the Health of the Workers," by C. F. Wright and James Beatty, M.D., D.P.H.; Col. J. Lane Notter, R.A.M.C., in the Chair.

"Pure Milk Supply," by C. W. Sorensen; W. Whitaker, B.A., F.R.S., F.G.S., in the Chair.

"Rural Housing—The Construction of Cheap and Healthy Cottages—The Exhibition at Letchworth," by J. F. J. Sykes, D.SC., M.D., and T. W. Aldwinckle, F.R.I.B.A.; Col. J. Lane Notter, R.A.M.C., in the Chair.

"Water Filtration." The Health Aspect, by A. Scarlyn Wilson, D.P.H., Pressure Filters, by P. H. Palmer, M.INST.C.E., and the Chemical Aspect, by H. F. Cheshire, B.SC., F.I.C.; Col. J. Lane Notter, R.A.M.C., in the Chair.

In connection with the meetings, visits were made to the following:—

City Hospital for Infectious Diseases, Newcastle-upon-Tyne.

Battersea Municipal Milk Depot, Disinfecting Station, Public Mortuary, Coroner's Court, and Shelter.

Ham Green Hospital for Infectious Diseases, Bristol.

Liverpool, Hornby Street Area (Rehousing).

Birmingham Rehousing Areas.

Bourneville Model Village.

Heatherside Sanatorium, Frimley.

Cambridge Water Works and Nine Wells, Stapleford.

York: White Rose Farm; new Earswick Cottages and new Cookery School in connection with Messrs. Rowntree's Works; and Infants' Milk Depot.

Northampton: Boot and Shoe Works of Messrs. Lewis; Refuse Destructor and Electric Generating Station.

Hastings Corporation Water Works at Brede.

The papers read and discussions upon them are printed in the Journal, Vol. XXVI.*

MEETING OF ASSOCIATES.

With a view of providing the Associates of the Institute with an opportunity of meeting together and discussing matters of sanitary interest, and of bringing before the Council any suggestions as to the work of the Institute that more especially affect the Associates as a body, the Council have arranged an annual meeting of Associates. The first of these meetings was held in March, when Dr. P. Boobbyer, Medical Officer of the city of Nottingham, Member of Council, gave an address on "The Training and Duties of a Sanitary Inspector." The chair was taken by Sir Shirley F. Murphy, Vice-President of the Institute. There was a large attendance of Associates, and after the address the subject of the evening was discussed, and several questions relating to the work of the Institute were raised and considered. Dr. Boobbyer's address is given in Vol. XXVI., Part 4, of the Journal of the Institute.

LECTURES AND DEMONSTRATIONS ON SANITARY SCIENCE.

Two Courses of Training for Sanitary Officers were held during the year, in the Spring and the Autumn, being the 39th and 40th Courses held by the Institute. Thirty-four Students entered for the Spring Course; and for the Autumn Course thirty-seven were enrolled. A complete list of each course of lectures was given in the supplementary pages of the Journal.

The lectures were made as practically useful as possible by the use of the various appliances and apparatus exhibited in the Museum, and specimens of diseased meat and organs of animals were obtained for the purposes of demonstration.

Technical Exhibitions are awarded to students by the Technical Education Board of the London County Council to the annual value

* The Council will be glad to receive any proposals as to subjects for discussion and centres in which future meetings might be held.

of five pounds, which may, with the approval of the Board, be applied to paying the expenses of students in attending these lectures.

Inspections and Demonstrations.

The training of the students so as to insure a practical knowledge of an inspector's work and duties is a point to which the Institute attaches much importance; and, in addition to the practical demonstrations given on the various appliances in the Parkes Museum, arrangements were made for the students to visit a number of public works illustrative of sanitary practice and administration, and the students were thus given the opportunity of observing and noting the practical application of sanitary principles.

The Institute is indebted to the London County Council, to Metropolitan Borough Councils and to District Councils, and others who are so kindly assisting them with regard to the visits, and in bringing the lectures under the notice of their officers.

Practical Training for Meat Inspectors.

In addition to the Course of general Lectures for Sanitary Officers, special Courses were arranged during the year for candidates preparing for the Examination for Inspectors of Meat and other Foods, conducted by The Royal Sanitary Institute.

Each Course consisted of two months' practical training in the inspection of meat at a Cattle Market, including demonstrations on live cattle and sheep, slaughtering and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangement of markets and byres, &c.

Demonstrations were also arranged at a knackers' yard, where instruction regarding the flesh and organs of the horse was given.

At the Spring Course there were 11 Students, and at the Autumn Course 9 Students.

The Special Course of Training in Food and Meat Inspection for Commissioned Officers and Professional Men, which was established in 1904, was repeated in the Spring and Autumn of 1905, and consisted of lectures on tinned and potted foods, milk, butter and cheese, fish, eggs, tea, coffee, cocoa, grains, bread, vegetables, condiments, preserved foods, beverages, etc., in addition to the lectures on Meat Inspection and practical demonstrations at the Cattle Market. The first Course was attended by 8 students, and the second by 7 students.

It is satisfactory to record the recognition given to this branch of

the Institute's work by the War Office, by the attendance of Officers of the Army Service Corps, specially detailed to take this Course of Instruction.

COURSE OF TRAINING IN APPLIED HYGIENE FOR SCHOOL TEACHERS.

A Course was arranged, in conjunction with Bedford College for Women; it occupied three terms of the year, and consisted of Lectures and practical Demonstrations on the following subjects:—

Physiology and the allied Sciences, Infectious Diseases and Disinfection,

Construction and practical Sanitation of Schools,

Hygiene in School life and in Educational methods.

The Lectures were given partly at the Institute and partly at Bedford College, and were attended by 32 Students.

EXAMINATIONS.

Since the decision of the Council that all candidates for the Inspectors of Nuisances Examination should produce satisfactory evidence of having had practical experience, the training of sanitary officers has been actively taken up by many Universities and Technical Schools throughout the country, and the course of instruction now includes, besides the lectures given by competent authorities, a series of visits to sanitary works and undertakings.

The training given at the following Universities is recognised by the Council as complying with the regulation as to practical training:—

The University of Liverpool.

The University College of South Wales & Monmouthshire, Cardiff.

And at the following Technical Schools:—

The Birmingham Municipal Technical Schools.

The Municipal School of Science and Technology, Brighton.

The Merchant Venturers' Technical College, Bristol.

The Heriot-Watt College, Edinburgh.

The Leeds Institute.

The Manchester Municipal School of Technology.

The Royal Technical Institute, Salford.

It has been found that candidates for the examinations sometimes commence a course of training which does not meet the requirements of the Institute's examinations, and in some cases even without seeing a copy of the syllabus. A note has therefore been

added to the regulations, advising candidates to write to the offices of the Institute for a copy of the syllabus and regulations before they commence to study for the examination.

During the year Examinations were held at the following places:

In Sanitary Science as applied to Buildings & Public Works.

Belfast	Liverpool (2)
Birmingham	London (2)
Cardiff	Manchester (2)
Edinburgh	Norwich
Hong Kong	Plymouth
Leeds	Sydney
Leicester	

92 Candidates presented themselves, to 35 of whom Certificates were granted.

For Inspectors of Nuisances.

Belfast	Leicester
Birmingham	Liverpool (2)
Brisbane	London (2)
Cape Town	Manchester (2)
Cardiff	Newcastle-upon-Tyne
Edinburgh	Norwich
Hong Kong (2)	Plymouth
Johannesburg	Sydney
Leeds	

At these Examinations 796 Candidates presented themselves, and 407 were certified competent, as regards their Sanitary knowledge, to discharge the duties of an Inspector of Nuisances under the Public Health Act, 1875.

The Sanitary Inspectors Examination Board (formed by The Sanitary Institute and other bodies), for holding Examinations under the Public Health (London) Act, 1891, held three Examinations during the year. There were 50 Certificates granted.

For Inspectors of Meat and Other Foods.

During the year Examinations were held in Cardiff, Leeds, Manchester, and London (2 Examinations). 62 Candidates presented themselves, to 46 of whom Certificates were granted.

In Hygiene in its Bearing on School Life.

During the year Examinations were held in Leeds, Leicester, and London. 24 Candidates presented themselves, to 16 of whom Certificates were granted.

COLONIAL EXAMINATIONS.

During the year Examinations were held in Brisbane, Cape Town, Johannesburg, Hong Kong (2), and Sydney.

Nine Candidates presented themselves for the Examination in Sanitary Science as applied to buildings and public works, to four of whom Certificates were granted.

Seventy-three Candidates presented themselves for the Inspectors of Nuisances Examination, 39 Certificates being awarded.

The results of the year's examination work in the colonies shew an increase in the number of centres where examinations have been held, and also an increase in the number of Candidates who have presented themselves. The work generally has been actively assisted by the Government Departments of the several colonies, and by Municipalities who have granted to students facilities for gaining practical experience in the duties of a Sanitary Inspector, in the same way that facilities are afforded by authorities to students in England. The Council are also pleased to note that the training of students by lectures and practical demonstrations has preceded the Examination in each case, and several of the Colonial Boards are taking steps to establish a museum of sanitary appliances in the Colony which would be accessible to students.

The Council have again to express their great appreciation of the services that have been rendered to the cause of Sanitary Science by the Officers and members of the Colonial Centres.

During the past year an additional centre has been established in South Australia with the assistance of Mr. T. G. Ellery, M.R.SAN.I., Town Clerk of Adelaide, who had in hand the local arrangements. A Board of Examiners has been elected of influential men, and Mr. J. E. Mitton has undertaken the duties of Hon. Local Secretary.

During the year the Institute have extended the Examination for Inspectors of Meat and Other Foods to Hong Kong, and an Examination is being arranged in this subject by the Board of Examiners of the Institute in that Colony.

The School Hygiene Examination has also been extended to Hong Kong, and the following is an extract from an official notification of this Examination issued by the Government of Hong Kong:—

> "Intending Candidates will find that the Course of Lectures at present being given under the auspices of the local Branch of The Royal Sanitary Institute, will be of value in enabling them to prepare for this Examination. The fee for this Course of Lectures, which extends to February, 1906, is $15, and copies of the sylla-

bus can be obtained on application to the Branch Secretary, Mr. ADAM GIBSON, at the Office of the Sanitary Board. A Course of Lectures on 'First Aid' will also be arranged for early in the New Year to supply the necessary instruction to intending Candidates in this part of the Examination.

"The Lecture fees and Examination fees for successful Candidates who are employed in Government or Grant-in-Aid Schools will be refunded to them by the Government."

The Council are also in communication with other Colonial centres with regard to further extending the Meat Inspectors' and School Hygiene Examinations.

New South Wales.

During the year the usual Examination was held in Sydney in December, for which there was a preparatory Course of Lectures. 2 Candidates presented themselves for the Sanitary Science Examination and were awarded certificates, and 7 for the Inspectors of Nuisances Examination, to 4 of whom certificates were granted.

The Council are in communication with the Chairman of the Board, Dr. J. Ashburton Thompson, as to extending the School Hygiene Examination to this centre.

Dominion of Canada.

No Examinations have been held during the year in this centre, but Dr. Starkey, the Hon. Local Secretary, has been engaged in formulating a scheme which has been adopted by the Council for extending the operations of the Board to other Provinces of the Dominion; and in addition to the Central Board established in Montreal (Province of Quebec), representatives have been appointed in the Provinces of Ontario, British Columbia, Manitoba, Nova Scotia, New Brunswick, and Alberta (North-West Territories), and it is hoped that during the coming year it will be found possible to arrange Examinations in these centres.

The efforts of Dr. Starkey in arranging the extension of the Examination Board have considerably increased the interest in the work of the Institute in Canada, and the Council are pleased to report that the membership of the Institute in the Dominion has been increased by about 30 members.

The question of extending the School Hygiene Examination to this centre is also under consideration.

British South Africa.

The Council are pleased to report that the last year has been one of increased activity in this centre. An Examination was held in

Johannesburg early in the year at which 37 Candidates presented themselves, and 16 Certificates were awarded. A preparatory Course of Lectures, including Practical Demonstrations, was held by the professional staff of the Public Health Department, the Town Engineer, and the Government Analyst.

Mr. T. Reunert, M.INST.C.E., is arranging a course of lectures in Pretoria and Johannesburg, under the auspices of the Transvaal Technical College.

A course of lectures was given in Cape Town in October by Dr. Anderson, Mr. A. H. Reid, and Mr. R. O. Wynne Roberts, and an examination was held on October 14th and 15th, 16 Candidates presenting themselves, and 8 Certificates were awarded.

Many of the Municipalities in Cape Colony now afford facilities for candidates gaining an insight into the duties of a Sanitary Inspector, notably, Cape Town, Port Elizabeth, and Woodstock.

During the year there have been several alterations in the personnel of the Board, and the Council are pleased to welcome the co-operation of the following new members of the Board:—Dr. G. Turner, Dr. P. Murison, G. S. Burt Andrews, M.INST.C.E., M.R.SAN.I., and Mr. John Cook, ASSOC.M.INST.C.E.

The Council wish to express their appreciation of the services rendered to the Board by Mr. H. P. B. Rigby, who resigned his seat when he left the Colony.

The Board are endeavouring to arrange a Museum of sanitary appliances in Cape Town, and efforts are being made to get the Museum housed in the Old Town Hall Buildings.

Dr. Anderson, the Medical Officer of Health of Cape Town, gave a lecture in Cape Town to students on School Hygiene, which is referred to in the Journal of the Institute, Vol. XXVI, page 190, and the question of extending the Institute's Examination in this subject to British South Africa is being considered.

Queensland.

Since the first Examination was held in Brisbane in 1901, the operations of this Board have been hampered by local difficulties in the carrying out of the Public Health Administration of the Colony, but the Council are pleased to report that a second Examination was held in December, and 5 Candidates presented themselves, to all of whom certificates were awarded.

The Council have to express their thanks to Mr. Peter Bancroft, Mr. H. J. Foster Barham, and Mr. W. C. Quinnell, who have resigned, for their services while members of the Board; and to

welcome as new members Mr. R. A. Fraser, M.R.SAN.I., and Mr. John Simpson, M.R.SAN.I.

Hong Kong and South China.

In the early part of the year a course of lectures was arranged for Meat Inspectors, and, upon the application of the Board, the Council have extended to this Colony the Examination for Inspectors of Meat and other Foods.

Two Examinations have been held during the year in Sanitary Science and for Inspectors of Nuisances, and courses of lectures have also been held preparatory to these Examinations. Seven candidates presented themselves for the Sanitary Science Examination and 2 certificates were awarded, and 8 for the Inspectors of Nuisances Examinations, to 6 of whom certificates were granted.

The Council have to report the resignation of Capt. Fitzwilliams, A.S.C., who has been an active member of the Board and who also took a special interest in the arrangements for the Examinations for Meat Inspectors, and the Council desire to record their appreciation of his services while on the Board. Also the resignation of Dr. Bertram Barnett, who has acted as Secretary to the Board since its inauguration, and to whom much of the success of the work of the Board is due. His successor, Mr. Adam Gibson, M.R.C.V.S., has taken a special interest in the establishment of the Meat Inspectors' and School Hygiene Examinations in the Colony.

The subject of School Hygiene has been brought forward by the Board, and at their request the Council of the Institute have extended the School Hygiene Examination of the Institute to this Colony. An official notification with reference to the examination has been issued by the Government of the Colony (*see page* 58).

Tasmania.

Active steps have been taken during the year to establish this Board on a satisfactory basis, and the Council understand that Dr. J. S. C. Elkington, the chief health officer, has in hand the preparation of a new Public Health Bill, the adoption of which measure should do much to enhance the success of the examinations.

A valuable series of lectures has been given during the year by Dr. Elkington on School Hygiene, and the question of extending the Institute's Examination in this subject to Tasmania is being considered.

South Australia.

After negotiations extending over some time the Council are pleased to report the establishment of an Examination Board in this

Centre in October last, and arrangements are being made to hold an Examination at an early date.

Western Australia.

This Board was established in 1901 but has not yet seen its way to arrange an Examination.

Examinations were established by the Institute in 1877, and the following figures show the total number of Examinations held, and the number of Candidates :—

	Examinations.	Candidates Entered.	Candidates Certificated.
For Local Surveyors	35	291	142
Sanitary Science as applied to Buildings and Public Works	106	628	278
Inspectors of Nuisances	212	10,165	5,383
Inspectors of Meat and Other Foods .	27	342	239
Hygiene in its bearing on School Life	13	81	54
	393	11,507	6,096

CONFERENCES.

During the year two Conferences were held in London.

On School Hygiene.

The Conference on School Hygiene was arranged in order to promote and maintain an interest in the subject pending the International Congress on School Hygiene to be held in London in 1907. The Royal Sanitary Institute, when urging the advisability of London for this meeting, had offered to co-operate in the organisation of the Congress and Exhibition, and informed the International Committee at Nuremburg that they proposed to hold a Conference on the subject early in 1905 to pave the way to the larger Congress two years later.

This Conference was held at the University of London, from Feb. 7th to 10th, 1905, under the Presidency of Sir Arthur W. Rücker, who delivered an Inaugural Address on "The Co-ordination of the Teaching of Hygiene."

His Grace the Duke of Northumberland, K.G., President of the Institute, took the chair at the opening meeting, and received the Delegates and Members. A Conversazione was arranged in the evening.

The discussions at the meeting were arranged under the following headings: –

"Scholars," under the presidency of SIR LAUDER BRUNTON, LL.D., M.D., F.R.C.P., F.R.S.

"Physical Inspection," under the presidency of RT. HON. LORD REAY, G.C.S.I., LL.D., D.L., J.P.

"Schools," under the presidency of SIR WILLIAM ANSON, BART., D.C.L., M.P.

"Sanitary Inspection," under the presidency of W. WHITAKER, B.A., F.R.S., F.G.S. (Chairman of Council).

"Training in Hygiene," under the presidency of SIR WILLIAM J. COLLINS, D.L., J.P., M.D., M.S., F.R.C.S.

"Training of Scholars," under the presidency of the Rt. Rev. the LORD BISHOP OF HEREFORD.

Delegates were appointed by 151 authorities.

The numbers attending the Conference were as follows:—Delegates, 310; Members and Associates of the Institute, 125; Associates of the Conference, 35; Complimentary and Press, 160; making a total of 630.

Dr. WALLER, the Director of the Physiological Laboratory at the University of London, kindly arranged to welcome and conduct members of the Conference round the Laboratory.

An Exhibition of School Building and Furnishing Appliances was held in connection with the Conference.

ON SMOKE ABATEMENT.

This Conference was arranged by The Royal Sanitary Institute in conjunction with the Coal Smoke Abatement Society, in order to discuss the question of the Abatement of Smoke and the evils attendant on Smoke production in large towns, as regards its bearing on the Public Health.

The Conference was held at the Royal Horticultural Society's Hall, Westminster, from December 12th to 15th, under the presidency of SIR OLIVER LODGE, F.R.S., D.SC., LL.D.

The discussions at the meeting were arranged under the following headings:—

"Domestic Smoke Abatement," under the presidency of SIR GEO. LIVESEY, M.INST.C.E., M.I.M.E.

"Factory and Trade Smoke Abatement," under the presidency of SIR WM. H. PREECE, K.C.B., M.INST.C.E., F.R.S.

"Administration, Legislation, and Necessary Reforms," under the presidency of SIR WM. B. RICHMOND, K.C.B., R.A.

Delegates were appointed by 54 authorities.

The numbers attending the Conference were as follows:—Dele-

gates, 102; Members and Associates of the Institute, 110; Associates of the Conference, 20; Complimentary and Press, 120; making a total of 352.

Visits were made to the Chelsea Generating Station of the Underground Electric Railways Co. of London, Ltd., to the Gas Works of the South Metropolitan Gas Co., Old Kent Road, and to the Abbey Mills Pumping Station of the London Sewage Outfall Works.

These visits were of great value to Members, and especially to Officers and Members of Local Authorities appointed as Delegates to the Congress.

EXHIBITIONS.

During the year two Exhibitions were held in London: one in February at the University of London, South Kensington, in connection with the Conference arranged by the Institute on School Hygiene; and one in December at the Royal Horticultural Hall in connection with the Conference on Smoke Abatement, arranged by the Institute in conjunction with the Coal Smoke Abatement Society. The Exhibitions were both open to the public for three days.

The School Hygiene Exhibition included exhibits of sanitary appliances specially adapted for school use, school desks and furniture, books, tools, cloak-room fittings, and other appliances used in connection with schools. Two silver and nineteen bronze medals were awarded by the Judges; a list of the premiated exhibits is given in the Journal, Vol. XXVI., Supplement pages, 27 and 71.

The exhibits at the Smoke Abatement Exhibition included gas heating and cooking appliances, shown by the Gas Light & Coke Co., and electrical heating and cooking appliances shown by the St. James' and Pall Mall Electric Light Co., and the Westminster Electric Supply Co. The exhibits in the main body of the hall were divided into three sections: Gas Heating and Cooking Appliances, Open Grates consuming coal, and Municipal and Trade Appliances for the prevention of smoke. Five silver and twenty-six bronze medals were awarded by the Judges, and a list of these is given in the Journal of the Institute, Vol. XXVI., Supplement pages 155–6.

LIBRARY.

Volumes and Pamphlets numbering 350 have been presented to the Library. Lists of these are published in the Supplement to the Journal.

JOURNAL.

During the year the period of publication was altered from once a quarter to once a month, in order that the record of the various meetings might be placed in the hands of the members as quickly as possible. The Council have also endeavoured to reduce somewhat the bulk of the records, so as to make them more easily read. The volume for the year consisted of 708 pages, with 156 pages of supplemental matter. The object of placing some of the matter in supplemental pages is to enable the members to omit this portion in binding the volume; for although the matter contained in these pages, Reviews of Books, Abstracts of Titles of papers appearing in English and Foreign periodicals, Calendar, and record of meetings is of considerable current interest, it is not of so much importance after the close of the year. But the supplementary matter is so arranged that it can be bound with the volume, or separately if desired.

INSTITUTE DINNER.

His Grace the Duke of Northumberland, K.G., President, presided at the Dinner of the Institute, held at the Princes' Restaurant on May 12th, at which there were 108 members and others present.

THE HENRY SAXON SNELL PRIZE.

The subject given in March last for the essays in competition for this Prize was "Domestic Sanitary Appliances, with Suggestions for their Improvement." Thirty-one essays were sent in and were brought under the consideration of the Council.

The majority of the essayists gave a more or less complete and generally well-illustrated description of existing sanitary appliances, pointing out which they considered the best, and the proper mode of fixing them, but failed to comply with the essential condition of "suggestions for their improvement."

The Council commended the following four essays on various grounds:—

Spero Meliora. Nairobi. Cordon Sanitaire. Efficientia.

The Council, however, did not consider that any of the essays were of sufficient merit to deserve the Prize, and therefore withheld the award.*

* The Prize is offered in 1906 for an Essay on "Suggestions for Improvements in Sanitary Appliances for use in workmen's dwellings and labourers' cottages under the varying conditions of water supply and drainage usually obtaining in towns and villages."

PARKES MUSEUM.

The collection of sanitary apparatus and appliances in the Parkes Museum has been largely added to during the period under review, seventy-four new exhibits having been received and placed in position. The repairs and decorations at the entrance to the Museum are now completed. Particulars of these additions to the Museum have been printed in the supplementary pages in the monthly Journal.

This continual addition to the exhibits is rendered necessary by the rapid advance of sanitary invention, and improvements in design made by the leading manufacturers; and while the Committee are anxious that the Museum should be kept as up-to-date as possible, and so maintained as to be practically useful for purposes of instruction, yet the problem of how to provide space for the ever-increasing demands is becoming more and more acute.

The educational value of the Museum continues to be appreciated by the various bodies engaged in scientific and technical instruction, and the large number of L.C.C. Evening Science Schools who have sent classes to the Museum during the year testifies to the interest in hygiene which has been aroused, and shows that the need for inculcating the principles and practice of this life subject is gradually becoming recognised.

The number of students who visited the Museum in organised classes was 1,820, and the number of institutions from which classes attended was 52.

The estimate of ordinary visitors for the year is 8,000.

It will thus be seen that 9,820 visits are recorded, and this number is in addition to the attendance at the various lectures and meetings held directly under the auspices of the Institute. One thousand eight hundred of these visits were made by interested students, coming to the Museum by appointment for definite instruction.

The following is a list of the institutions from which classes attended, some of them sending classes on several occasions:—

Allen Street School, Kensington.
Barnsbury Park School.
Battersea Polytechnic.
Beckenham Technical Institute.
Bedford College for Women.
Blackheath Road School.
Bloomfield Road School.
Bow and Bromley Institute.
Brockley Road School.
Carpenters Company's Institute, Stratford.
Cavendish Square Convent.
Charing Cross Hospital (Medical Students).
Crompton Street School.
Croydon Polytechnic.
Dartford Technical Institute.
East London Technical College.
Erith Central Council Schools.

Goldsmiths' Institute.
Hackford Road School.
Hackney Parochial School.
King's College.
Kingston Science & Art School.
Lavender Hill School.
L. C. C. Day Training College.
Lillie Road School, Fulham.
London Hospital Medical College.
London Hospital Nurses' Home.
National Training School of Cookery.
National Health Society.
Northampton Institute.
Northern Polytechnic.
Offord Road School.
Paddington Technical Institute.
Queen Victoria's Jubilee Institute for Nurses.
Regent Street Polytechnic.
Rutland St. H.G. Girls' School.
Sesame House.
Skinners Company's School (Girls).
St. Mary's Hospital Medical School.
St. Thomas's Hospital Medical College.
South-Western Polytechnic.
Sumner Avenue School.
Thomas Street School.
Tottenham Polytechnic.
Tottenham Road School.
University College (Public Health Students).
Wandsworth Institute.
West Norwood Institute.
Whitelands Training College, Chelsea.
Willesden Polytechnic.
William Street Science Centre.
Women's School of Medicine.

The collection of Lantern slides available to Members and Associates for lecture purposes has been taken advantage of by a good number of Members and Associates, 606 slides having been hired during the year.

FINANCE.

The Statement of Income and Expenditure shows a slight balance of receipts over working expenses. The general establishment expenditure shows a slight increase, owing to the greater cost of posting the monthly Journal to the members, and the larger provision made for Sinking Fund to cover contingencies.

In the items of special expenditure, the nett cost of the Journal is considerably reduced, and some of the other items show an increase on account of the growth of the work of the Institute, especially the cost of the Sessional Meetings, which are now held in a number of provincial centres.

On the other side of the account, the income from annual subscriptions shows a steady increase, and the receipts from Examinations have also increased.

The General Balance Sheet shows an Accumulated Fund of £6,815 3s. 6d., in addition to the amounts allotted to the New Premises Fund and to other special purposes.

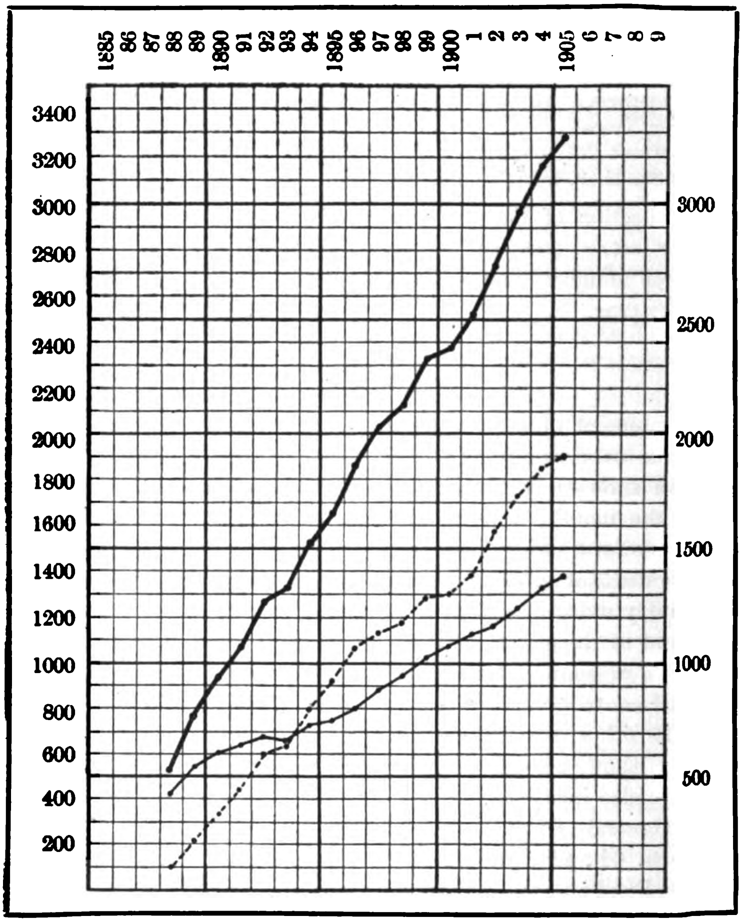
EPITOME OF REGISTERS OF MEMBERS AND ASSOCIATES.

The comparison of the roll of the Institute with that of the preceding year shows that the number of Members and Associates is steadily growing.

	Hon. Fellows.	Fellows.	Members.	Associates.	Total.
Dec. 31st, 1904	43	193	1,083	1,836	3,155
Dec. 31st, 1905	42	207	1,141	1,900	3,290

Diagram showing the Yearly Increase in the Roll of the Institute.

Fell. and Mem. Assoc. Total



OBITUARY.

It is with regret that the Council have to report the death of the following:—

Vice-Presidents: EARL FORTESCUE and ALFRED WATERHOUSE, R.A.

Member of Council: H. H. COLLINS.

Hon. Fellow: DR. J. FELIX.

Fellows: THOMAS BLASHILL, W. HORTON ELLIS, and JAMES MANSERGH.

Members: J. CARLINE, P. J. CORBETT, J. E. FOTHERGILL, Dr. OGILVIE GRANT, R. KERSHAW, CHARLES H. LOWE, SAMUEL MATHER, F. D. MOCATTA, Dr. JAMES ROBERTSON, and S. W. SILVER.

Associates: Miss F. K. CALLOW, W. H. CRANE, W. H. CURTIN, G. DARLEY, F. H. DILKE, Miss A. GAMMON, ALEXANDER GUNN, H. MARDELL, JOSEPH PRATT, and Mrs. K. THOL.

EPITOME OF THE WORK OF THE INSTITUTE, 1905.

	LONDON MEETINGS AND EXAMINATIONS.	Total Attendance
4	Sessional Meetings for discussion of Sanitary subjects ..	281
66	Lectures, Sanitary Officers and Sanitary Science Courses	2,804
2	Special Demonstrations, Inspection of Meat	120
38	Practical Demonstrations for Sanitary Officers	750
2	Examinations in Sanitary Science as Applied to Buildings and Public Works	45
2	Examinations for Inspectors of Nuisances	170
2	Examinations for Inspectors of Meat	43
1	Examination in Hygiene in its bearing on School Life ..	4
166	Council and Committee Meetings	892
	Ordinary General Meeting and Associates' Annual Meeting	75
105	Classes brought to the Museum	1,820
	Other persons visiting the Museum *(Estimated)*	8,000
21	Lectures on School Hygiene *(Estimated)*	600
2	Courses of Practical Instruction for Meat Inspectors lasting two months each *(Estimated)* ..	500
2	Special Courses on Meat and Food Inspection *(Estimated)*	400

CONFERENCES AND EXHIBITIONS.	
Conference on School Hygiene & Exhibition (7 meetings)	2,000
Conference on Smoke Abatement (4 meetings)	750
Smoke Abatement Exhibition, open for 3 days *(Estimated)*	750

PROVINCIAL AND COLONIAL MEETINGS.

8	Sessional Meetings	675
14	Examinations in Sanitary Science as Applied to Buildings and Public Works	47
19	Examinations for Inspectors of Nuisances	626
3	Examinations for Inspectors of Meat and other Foods ..	19
2	Examinations in Hygiene in its bearing on School Life	20

J. LANE NOTTER,

Chairman of Council.

E. WHITE WALLIS.

Secretary.

April 11th, 1906.

STATEMENT OF INCOME AND EXPENDITURE

AND

GENERAL BALANCE SHEET.

STATEMENT of INCOME and EXPENDITURE

Dr. EXPENDITURE.	£ s. d.	£ s. d.
Establishment Charges:—		
To Rent, Rates, Taxes, and Insurance	493 18 8	
„ Salaries and Wages	1,623 18 10	
„ Coals, Lighting, and Care of Offices	96 7 4	
„ Repairs and Alterations	26 13 3	
„ Arrangement of Museum	40 7 5	
„ Library, Binding, &c.	4 12 7	
„ Postage, Telegrams, Telephone & Carriage	409 2 0	
„ Printing and Stationery	337 4 0	
„ Advertising	5 4 9	
„ Incidental Expenses	134 17 11	
„ Office Furniture	20 10 7	
„ Transferred to Sinking Fund for Contingencies	30 0 0	
		3,222 17 4
Special Expenses, exclusive of Establishment Charges:—		
To Journal and Publications, Cost of Printing, etc., less Sales and Advertisements	439 13 5	
„ Sessional Meetings	132 18 7	
„ Lectures, Sanitary Officers	255 2 5	
„ „ School Hygiene	20 1 10	
„ „ Meat Inspectors	102 17 1	
„ Examination Expenses	1,336 0 3	
„ „ „ Colonial	217 7 3	
„ School Hygiene and Smoke Abatement Conferences	306 13 2	
„ School Hygiene and Smoke Abatement Exhibitions	702 11 9	
„ List of Awards to Exhibits	18 14 1	
„ Experiments	20 13 9	
„ Institute Dinner—Balance of Expenses ...	28 12 4	
„ International Congress on School Hygiene	38 0 5	
		3,619 6 4
„ Balance carried to Accumulated Fund		17 9 9
		£6,859 13 5

ACCUMULATED

To Expenses on account of New Premises Fund	115 2 2
„ Balance to be carried forward to next account	6,815 3 6
	£6,930 5 8

for the Year ending 31st December, 1905.

INCOME.

	£	s.	d.	£	s.	d.
General Receipts:—						
By Annual Subscriptions, less Arrears written off	2,380	6	0			
„ Interest on Investments, etc.	462	12	10			
				2,842	18	10
Special Receipts:—						
„ Lectures, Sanitary Officers	234	0	10			
„ „ School Hygiene	13	16	4			
„ „ Meat Inspectors	107	12	6			
„ Examinations	2,462	10	1			
„ „ Colonial	252	3	3			
„ Conferences	128	2	1			
„ Exhibitions	816	9	6			
Farr's Works	2	0	0			
				4,016	14	7
				6,859	13	5

FUND.

	£	s.	d.
By Balance brought forward from last account, 1904	6,912	15	11
„ „ for the year brought down	17	9	9
	£6,930	5	8

NEW PREMISES

	£	s.	d.
To Balance carried forward to next Account	10,167	11	6
	£10,167	11	6

SAXON SNELL

	£	s.	d.	£	s.	d.
Printing, Postage, and Sundries				8	10	11
Carried forward to next Account:—						
Funded Capital	700	0	0			
Balance available for Prizes and Expenses	62	18	9			
				762	18	9
				£771	9	8

GENERAL BALANCE SHEET,

Liabilities.	£	s.	d.	£	s.	d.
To Fees and Subscriptions paid in advance for 1906	174	19	6			
„ Sundry Creditors	1,293	1	2			
				1,468	0	8
„ Library Catalogue Account, Balance at Credit thereof	98	2	9			
„ Life Composition Fund, Balance at Credit thereof	564	18	0			
„ New Premises Fund, Balance at Credit thereof	10,167	11	6			
„ Sinking Fund, Balance at Credit thereof	40	0	0			
„ Saxon Snell Prize Fund, Balance at Credit thereof	762	18	9			
				11,633	11	0
„ Income and Expenditure Account, Balance at Credit thereof				6,815	3	6
				£19,916	15	2

Examined with the Books, Vouchers, and Accounts, and found correct,

4th April, 1906.

FUND.

	£	s.	d.
By Balance brought forward from last Account	9,753	3	0
„ Donations	414	8	6
	£10,167	11	6

Further donations have been promised to the amount of £1,048 4s. 0d.

PRIZE FUND.

	£	s.	d.
By Balance brought forward from last Account	750	0	0
„ Interest	20	13	3
„ Sundries, prepaid Postages		16	5
	£771	9	8

31st DECEMBER, 1905.

Assets.	£	s.	d.	£	s.	d.
By Library and Contents of Museum, Furniture and Publications	1,512	18	8			
„ Subscriptions in Arrear	197	18	6			
„ Sundry Debtors	791	14	6			
„ Cash in hand	189	6	0			
				2,691	17	8
„ Investments valued at Cost—						
£7,908 11 1 2½% Consols.	7,672	16	0			
£1,000 0 0 3 % India Stock	1,095	1	0			
£1,000 0 0 3½% „	1,156	6	0			
£5,500 0 0 4 % New Zealand Stock	6,098	4	6			
£500 0 0 3½% New South Wales Stock	502	10	0			
£725 7 9 3% Metropolitan Water Board Stock	700	0	0			
				17,224	17	6
The Market Value of these Securities on Dec. 30th, 1905, was £16,143 13s. 10d.						
				£19,916	15	2

Wood, Drew & Co., Chartered Accountants, }
W. Collingridge, M.D. } *Auditors.*

Thomas W. Cutler, *Treasurer.*

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in relation to Hygiene and Preventive Medicine.

MACFADYEN, ALLAN, M.D. Upon the Properties of an Antityphoid Serum obtained from the Goat. *British Medical Journal*, 21st April, 1906, p. 901.

Facts too numerous and detailed to allow of summary.

MORGAN, H. DE R., M.R.C.S., F.R.C.P., &c. Upon the Bacteriology of the Summer Diarrhœa of Infants. *British Medical Journal*, 21st April, 1906, p. 909.

The association of various types of organisms in the stools, blood, or organs of patients is discussed.

TEACHER, JOHN H., M.D. Primary Intestinal Anthrax in Man; Septicæmia; Hæmorrhagic Lepto-Meningitis. *The Lancet*, 12th May, 1906, p. 1306.

Can be completely isolated, and its nature only discovered on post-mortem examination.

THRESH, JOHN C., M.D. The Utility of Isolation Hospitals. *The Lancet*, 14th April, 1906, p. 1058.

Figures are given which seem to indicate that isolation hospitals do not fulfil their purpose in curtailing outbreaks of infectious disease.

Building Materials, Construction, and Machinery.

MILLER, RUDOLPH P. The Proper Legal Requirements for the Use of Cement Constructions. *Engineering Record*, 28th April, 1906, p. 538.

A paper read before the Concrete Association and the National Association of Cement Users, covering tests for cement, mixtures for concrete, stresses in reinforced concrete.

Water Supply, Sewerage, and Refuse Disposal.

"ENGINEERING RECORD." Experiments with Copper-Iron Sulphate for Water Purification at Mariotta, Ohio. 24th March, 1906, p. 392.

Description of reinforced concrete chemical tanks and pumps and mode of applying chemicals, with diagrams of bacterial tests of results.

———. The Official Prussian Tests of the Jewell Water Filter. 21st April, 1906, p. 499.

A description of the tests made by the Royal Prussian Institution for the investigation of water supply and sewerage into the American mechanical system of water purification.

MEETINGS HELD.

The Ordinary General Meeting was held in the Parkes Museum on May 2nd, Col. J. Lane Notter, R.A.M.C., presiding.

His Grace the Duke of Northumberland, K.G., F.R.S., was elected President of the Institute, to hold the office until the year 1913.

The following were elected:—

As Vice-Presidents.

Right Hon. Earl Egerton of Tatton.
Right Hon. Earl Stamford.
Right Hon. Lord Avebury, P.C., D.C.L., F.R.S.
Sir Benjamin Baker, K.C.B., K.C.M.G., LL.D., F.R.S., M.Inst.C.E.
Sir Joseph Fayrer, Bart., K.C.S.I., LL.D., M.D., F.R.S.
Sir Shirley F. Murphy.
Sir Alexander Binnie, P.Inst.C.E.
Sir Francis Sharp Powell, Bart., M.P.
Sir William Henry Preece, K.C.B., F.R.S., M.Inst.C.E.
Sir Aston Webb, R.A., F.R.I.B.A.
A. Wynter Blyth, Barrister-at-Law, M.R.C.S., F.I.C.
Robert Farquharson, LL.D., M.D.

As New Members of Council.

Col. R. H. Firth, R.A.M.C.
E. T. Hall, V-P.R.I.B.A.
J. R. Kaye, M.B., C.M., D.P.H.
H. R. Kenwood, M.B., D.P.H.
E. G. Mawbey, M.Inst.C.E.
J. C. Melliss, M.Inst.C.E.
R. Plumbe, F.R.I.B.A.
J. E. Worth, M.Inst.C.E.

As Treasurer.

Thomas W. Cutler, F.R.I.B.A.

As Auditors.

W. Collingridge, M.A., M.D., LL.B., D.P.H.
Wood, Drew, & Co.

Institute Dinner.

The Institute Dinner was held at the Langham Hotel, on Wednesday, May 9th, 1906, His Grace the Duke of Northumberland, K.G., President of the Institute, in the Chair. Eighty-five members and guests were present, amongst whom were:—Sir Francis Sharp Powell, Bart., M.P., Vice-President; Sir Lauder Brunton, LL.D., F.R.S.; Surgeon-General A. Keogh, Director-General, Army Medical Service; Sir R. Melvill Beachcroft, Chairman of the Metropolitan Water Board; Sir Alexander Binnie, Vice-President; Evan Spicer, J.P., Chairman of the London

County Council; Sir Shirley F. Murphy, Vice-President; Sir Thomas Drew, President Royal Hibernian Academy; Rev. Canon Barker; H. F. Hepburn, Chairman of the Public Health Committee, City of London; Sir Henry Tanner; A. Wynter Blyth, Vice-President; Councillor Dr. Colston Wintle, Chairman of Health Committee, Bristol; Dr. D. S. Davies, M.O.H., Bristol; Dr. J. Poland, President of the Hunterian Society; the Master of the Worshipful Company of Carpenters; the Master of the Worshipful Company of Plumbers; Col. J. Lane Notter, R.A.M.C., Chairman of Council; and the Council of the Institute.

THE CHAIRMAN, in proposing the toast of "The King," stated that His Majesty, who was Patron of the Institute, had within the last few days still further shown his interest in the work with which the Institute was connected by granting his patronage to the International Congress on School Hygiene, which was to meet in London next year, and in the organisation of which meeting The Royal Sanitary Institute was taking an active part.

Responding to the toast of "The Navy, Army, and Auxiliary Forces," proposed by Sir Lauder Brunton,

SURGEON-GENERAL A. KEOGH, Director-General of the Army Medical Service, said that the responsibility of that branch of the Army which he had the honour to represent was very great indeed. He was glad to have that opportunity of speaking, for the first time since his appointment, to a body of scientific men not composed altogether of members of his own profession, in regard to the relations which should exist between The Royal Sanitary Institute and the Army generally. He was one of those who believed that the Army Medical Service has progressed along a line which had been very important indeed, i.e., as to serving the function of relieving the sick and wounded in war, but he was not perfectly satisfied that that should be considered the first duty of an army medical service. He held that its first duty was the prevention of disease. He much regretted that the ideas of the medical service in the past had not been directed along an entirely different line from that on which it had progressed. Parkes, whose name was so eminently associated with that Institute, was the father of military hygiene, and the history of hygiene in this country was the history of military hygiene in the Army up to the time of Parkes's death. The prevention of disease was a part of the art of war, and was a science with a distinct relation to the fighting and winning of battles. The object of an army was to win battles, while the tending of the sick and wounded was a purely humanitarian work. Hence the science of disease prevention was a science upon which they could all think. He was bound to tell them that to-day he did not believe we are more efficient in the prevention of disease in the Army than we were in the year 1899, when we embarked upon a great war very much larger than we expected it would be. During that war we had 40,000 cases of enteric fever. He said that was a disgraceful thing when they came to think of how modern science had

progressed since the days of Parkes. He held that if we went to war again with 250,000 men we ought not to have 40,000 cases of enteric fever. Modern science, as elucidated by Pasteur, who began the work, had given us definite knowledge of the origin of enteric fever, and of the method of dissemination of communicable disease in war. At the present moment they were trying to translate that knowledge into Army administration. He was one of those who believed that no sanitary recommendation should be made to the authorities unless they had a good chance of successfully working it out in practice, unless the statements they made had a definite scientific foundation, unless they were able definitely to promise certain results if a certain scheme was put in operation. So far army sanitation had been largely a matter of experiment; good results had not been produced, and so sanitation had more or less fallen into disrepute in the Army. Now, scientific sanitation at the present moment appeared to be not so scientific as a large number of people would imagine, that is to say, the translation of scientific knowledge into administration would not appear to be so accurately dealt with as one would suppose anything which had a scientific foundation should be, because they would find that in the last two or three years the method of the prevention of enteric fever in war does not appear to have been dealt with or decided upon very definitely by the various people who have written on the subject. When we speak to soldiers, when we say this method will prevent enteric fever, we find one body of scientific men say it will, and another body say it will not. But he could not go to the authorities with any scheme the results of which were uncertain. Recent scientific work demonstrates most clearly that enteric fever is largely but not altogether a question of water. Then they had also the question of the disposal of refuse, but they did want in the service a definite method of providing an army in the field with pure water. All water in war is impure, water derived from rivers, streams, and canals; that could be accepted as a fundamental principle, and therefore it followed that an Army in the field should be in a position to supply itself with pure water. It was no use stopping to consider why water is the most potent factor in the dissemination of enteric fever in war. They knew it to be a fact. Let them accept it, and decide that the Army should have pure water. Some people laid great stress upon the point, others less stress. He had carefully considered the subject for the last two or three years, and had found it very difficult indeed to reconcile the conflicting opinions; it was also a very difficult thing to reduce this scientific opinion to practice. But he thought they had solved that problem at last. He had come to the conclusion that it was impossible to adopt any system of boiling water for a field army, but he believed it is possible to adopt a system of filtration by means of the ordinary water-carts. A water-cart had been invented, which had been subjected to bacteriological tests, and had proved durable and efficient; that filtering machinery was easily adaptable to the ordinary service water-cart. He therefore considered that this problem of a pure water supply to a fighting army was on the eve of solution, and was perfectly prepared to recommend that system for the prevention of disease

in a field army. With regard to bases and lines of communication, boiling and methods of chemical treatment were practicable. But there was one other point to which he desired to allude. The Army Medical Service found themselves in a somewhat extraordinary position. It was possible for them to get enormous outside help in the direction of the treatment of the sick and wounded; but they got absolutely no help whatever from sanitarians and scientists, as well as members of his own profession, in regard to the prevention of disease in war. Whereas there were many organisations in civil life for treating the sick and wounded, ambulance corps, brigade bearer companies, and so forth, which were quite prepared to organise for the humanitarian branch of the work, yet they had not got one definite organisation in civil life to help them prevent disease. Looking at that fact from an administrative point of view, he said that it was discreditable to sanitarians, and he hoped that this question would be taken up by a civilian organisation in the time of peace in order that they might be assisted to prevent disease in the time of war. It was an important subject from the point of view of the fighting and winning of battles; and that, after all, was the only object and the great object military administration had in view. For this he wanted the co-operation and support of sanitarians.

The President, in proposing the toast of the evening, said: You are a very successful body of men, your Institute goes on from year to year, it does its useful work without any marked change or incident, and I do not know that there is anything more difficult than to make an annual speech under conditions such as that. You have attempted to find yourselves fresh quarters, and so far that effort has not been crowned with success. I am not going to condole with you on that circumstance. I think in some respects it is a good thing, because I am quite sure that when an individual or a public body changes its habitation it is a very good thing to do it deliberately. You are accumulating funds, and you have received much encouragement from various quarters, and I am more particularly glad to see that some public bodies, notably the Corporation of Wigan, and no fewer, I think, than some half-dozen of the City companies of London, have come to your support. That shows, I think, in a very marked way, that the value of your Institute is recognised by those who have charge of the public welfare. I do not lament, as I said before, that your progress is slow, because I am certain that it will be sure. But you will keep that object before you, and I trust that before very long the Institute may find a habitation worthy of its importance and of its work. We have heard something from Sir Francis Powell as to the conditions of Parliament. I do not know that I can congratulate you altogether upon the attention which Parliament appears to be giving to sanitary matters. We hope for better things, but in one respect I am very sorry to see that we have had rather a cold water douche put upon us, viz., in the matter of vaccination. I have taken some interest myself in the revaccination of the population, and I believe that that is an absolutely necessary step which the legislature will have to take sooner or later to safeguard our

population, and I cannot but regret that temporarily we have sustained, I am afraid, a small pull back. But in another direction we have received encouragement. That is in the Public Health Amendment Bill. That is a most sensible Bill (and I speak with some experience as a landed proprietor), calculated very greatly to assist us in the proper housing of the population. I am very pleased to see that this Institute has petitioned in favour of that measure, and I trust that all those who wish to see our population better housed than they are now will do all they can to promote some legislation in that direction. We had a great effort last year to teach landed proprietors how to build their houses by the Garden City Exhibition. I applaud the intention and the effort, but I was rather disappointed with the result. I went down there myself with some advisers, who were, I think, well qualified to advise me, and I cannot say that on the whole we were very greatly assisted in solving the problem. It would be unjust and ungrateful to say that we got no hints. Some valuable hints were given to us, but until you have some such legislation as this, and amendment of the present by-laws of the local bodies, we shall not be able to solve that most important problem, how to house the working classes. I will only mention one other subject. An Institute of this importance ought not to be parochial. These are days when one is told to think imperially. I am especially glad to see that the Council of this Institute thinks imperially, and that we are spreading our work and trying to teach our lessons in British possessions all over the world. I see here in the Report of the Institute that there are no less than eight Colonies in which we are doing work, instituting examinations and in other ways trying to press forward sanitary questions. I am delighted to see that we are advancing in that direction, and not confining our attention simply to this country, with which probably we all here are most conversant. We have heard from General Keogh something of the necessities of the Army, which again is a subject that I think is well worth our attention as not being simply parochial. I should like to suggest whether there is not one great drawback to advance in that direction existing in the regulations and status of the Army Medical Service. I do not want at this late hour to enter into controversy, but I am bound to say I think the Army Medical Service is not properly treated and properly considered, that the prizes placed within the reach of men engaged in that profession are such as they ought to be, and I hold myself—and it is not an opinion formed very recently—that it is in that direction we are to look for some great improvement in the sanitary condition of our Army Service. But we are all advancing, we are all thinking more and more of our Colonies, and of all those great dependencies of which England can boast; and I should like to remind you of one thing, that the great interest in what is termed tropical medicine is a fact of very great importance in the sanitary condition of our Colonies. We ought to be very grateful, I think, to the schools in Liverpool and London, which are working to improve the sanitary condition of our Colonies, and we ought in every way in our power to assist and support their efforts. I couple this toast with the name of Col. Notter, the Chairman of the Council of the Institute. He, far more than

any one else I may say, and the other officers of the Institute also, merit our gratitude.

MR. ALDERMAN EVAN SPICER, J.P., Chairman of the London County Council, in responding to the toast of "The Visitors," proposed by Sir Alexander Binnie, warmly thanked the Institute for the technical knowledge which it placed at the disposal of such public bodies as the London County Council. Everyone made mistakes at times. He thought the Institute did a most useful work in critically examining Bills introduced into Parliament, and assisting promoters in a way that public bodies ought to commend. Public bodies were indebted to the Institute in other ways, for it helped to train and examine candidates for various important posts. Many of the inspectors under the London County Council had passed the examinations of The Royal Sanitary Institute, while he could also mention that a niece of his went through the Institute's course, took her certificate, and was now an inspector under the Home Office doing, he hoped, good work for the public. Sanitary authorities had an important work to do in acquiring slum property and in providing better accommodation for the working classes; and the papers read before the Institute and the Conferences which the Institute held were of much use to these authorities. He hoped they would always work hand in hand with that institution, and be willing to avail themselves of their expert help and guidance.

SESSIONAL MEETINGS.

Bournemouth, May 26th. The Meeting was held in the Council Chamber, May 26th, 1906, when a Discussion on "Sanitary Administration in a Health Resort," was opened by Philip W. G. Nunn, L.R.C.P., M.R.C.S., M.O.H. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C. The members were welcomed by the Mayor, Alderman Parker, and facilities for visiting the Isolation and Royal Boscombe Hospitals and other places of interest were afforded by the Sanitary Committee who entertained the members.

EXAMINATIONS.

Sanitary Science as applied to Buildings and Public Works.

London. May 4 and 5. 24 Candidates. 7 Certificates granted.

Inspectors of Nuisances.

London. May 4 and 5. 101 Candidates. 50 Certificates granted.

Hygiene in its Bearing on School Life.

London. May 4 and 5. 15 Candidates. 5 Certificates granted.

Inspectors of Meat and Other Foods.

London. May 11 and 12. 33 Candidates. 25 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Barlass, Thomas.
Harding, Walter Denis.
Golds, Alfred.
Polkinghorne, George Henry.
Wainwright, Walter Hepburn.
Ward, Thomas.
West, Richard Alexander.

Inspectors of Nuisances.

Ash, Horace James.
Ashwood, Herbert.
Bristow, Samuel Percy.
Brockett, Frederick James.
Caesar, Francis George.
Camble, Frederick.
Cooper, Frederick Wade.
Corin, Herbert Richards.
Cross, Charles George Melville.
Cuckney, Alfred John.
Davies, Mary.
Diggle, James.
Donovan, Helen.
Dow, Mary.
Edwards, Leslie Ernest.
Faulkner, Henry Robert.
Flaxman, Charles William.
Gardner, Thomas.
Goddard, Frederick Brokenshire.
Goodall, Herbert Samuel.
Hall, William Ewart.
Holman Frank Sinclair.
Jacobs, Julie Amélie.
Jeffery, Edgar T.
Kempster, Harry.
Knowles, George, Junr.
Lowe, Mary.
McNair, William.
Miller, Elizabeth.
Northmore, William Shillibeer.
Packer, William George.
Perrin, John Manoah.
Pitstow, George.
Rayner, Sidney Parker.
Rees, Alfred Edward.
Reynolds, George Henry.
Ryder, Ernest Edward.
Saint, Russell George.
Salvage, Frederick Wm.
Seckerson, Frank.
Small, Victor Andrew.
Stanfield, Herbert Finlay.
Taylor, Harry T.
Teasdale, Bessie.
Thomas, Arthur.
Wallis, George William.
Weaver, Eliza.
West, John Thomas.
Whitlock, Ada Miles.
Wilson, Annie R.

Inspectors of Meat and Other Foods.

Cannot, F. E., *Capt.*, A.S.C.
Clayton, William Ellis.
Cleeve, Herbert, *Capt.*, A.S.C.
Coleman, Horace.
Cooper, John Alfred Kempster.
Courtney, Edward Arthur Waldegrave, *Major*, A.S.C.
Cumpston, John Howard Lidgett.
Davis, Richard James.
Down, William Edward.
Emerton, William John.
Fitt, Arthur Hemming.
Fitzwilliams, Edward Crawford Lloyd, *Capt.*, A.S.C.
Goreham, James Edward.
Grimer, Thomas Ingledew.
Hill, Charles.
Hunkin, Harry.
Jones, Herbert Arthur, *Capt.*, A.S.C.
Leese, Arnold Spencer, M.R.C.V.S.
Little, William.
Lloyd, Charles Burton.
Longden, Charles Matthew.
Norman, Ernest Archibald.
Pointon, Joseph Bertram.
Striedinger, Oscar, *Capt.*, A.S.C.
Underhill, Thomas John.

Hygiene in its Bearing on School Life.

Foulsham, Jessie Gladys.
Lloyd, Adelaide J.
Martyn, Gladys Winifred.
Turner, Maria Elizabeth.
Underhill, Esmé Gladys.

The following candidate was successful in Part I.:—

Hopkinson, Dorothy.

The following Candidates were successful in Part II.:—

Disney, Alice Matilda.
Galloway, Elsie Margaret.
Power, Mary Douglas.
Say, Annie Louisa.
Waterhouse, Clara.

FORTHCOMING MEETINGS.

Sessional Meetings.

Derby, June 29th and 30th. Discussion on "The Provision of a Pure Milk Supply," to be opened by S. Barwise, M.D., B.Sc., County M.O.H., and J. White, F.I.C., Public Analyst, Derby.

On Saturday, June 30th, visits will be made to Messrs. Nestle's Works at Tutbury, and to the Derby Sewerage Works.

Congress, 1906.—Bristol, July 9th–14th.

A Preliminary Programme of the Congress is given at pages 90–108.

Examinations.

In Sanitary Science as Applied to Buildings and Public Works and for Inspectors of Nuisances, and in Hygiene in its Bearing on School Life—

York, June 1st and 2nd.
Leeds, June 15th and 16th.
Manchester, June 22nd and 23rd.

For Inspectors of Meat and other Foods—

Liverpool, June 29th and 30th.

Calendar, June and July, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

JUNE.

1 F. } 2 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, York.

15 F. } 16 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Leeds.

22 F. } 23 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Manchester.

29 F. **Sessional Meeting**, at 7.30 p.m., Derby. Discussion on "The Provision of a Pure Milk Supply," to be opened by S. Barwise, M.D., B.Sc., County M.O.H., and J. White, F.I.C., Public Analyst, Derby.

30 S. Visit to the Nestle's Milk Factory at Tutbury, and to the Sewerage Works, Derby.

29 F. } 30 S. } Examination for Inspectors of Meat and other Foods, Liverpool.

JULY.

9-14 **Congress, Bristol.**

9-21 **Exhibition ,,**

20 F. } 21 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Cardiff.

MEMBERS AND ASSOCIATES ELECTED.

May, 1906.

MEMBERS.

2081 1906. May. Boby, William, ASSOC.M.INST.C.E., *Salisbury House, London Wall, E.C.*

2082 1906. May. Bush, Ernest A., *Surveyor and Sanitary Inspector, Beeston, Notts.*

2083 1906. May. Collins, Marcus Evelyn, F.S.I., 61, *Old Broad Street, E.C.*

2084 1906. May. Cottle, Frank, *Borough Engineer and Surveyor, Town Hall, Douglas, Isle of Man.*

2085 1906. May. Dilley, Wilfred Joseph, ASSOC.M.INST.C.E., B.SC. (ENG.), *School of Engineering, Gizeh, Cairo, Egypt.*

2086 1906. May. Hayes, Robert Thomas, ASSOC.M.INST.C.E., 43, *Marle Hill Parade, Cheltenham.*

2087 1906. May. Honey, Robert Llewellyn, P.A.S.I., *Assistant Borough Surveyor, Chatham, Kent.*

2088 1906. May. Maddocks, Arthur Percy, ASSOC.M.INST.C.E., *Stoneycross, Spondon, Derby.*

2089 1906. May. Marsh, Francis Edward, 81, *Lichfield Grove, Finchley, N.*

2090 1906. May. Newman, William Walter, P.A.S.I., *Shepshed, Loughborough, Leicester.*

2091 1906. May. Norman, Arthur Charles Alfred, F.R.I.B.A., 13, *Cecil Road, Norwich.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

3837 1906. May. ‡Allen, Harold George, *Highfield, Metheringham, Lincolnshire.*

3838 1906. May. ‡Clapham, Harry, 44, *Ince Green Lane, Ince, near Wigan.*

3839 1906. May. ‡Grey, David, 174, *Carlisle Street, Splott, Cardiff.*

3840 1906. May. ‡Holt, Walter, *Sanitary Inspector, Muizenberg, Cape Colony, S. Africa.*

3841 1906. May. ‡Hulton, William Ankers, 8, *Church Road, Lower Crumpsall, Manchester.*

3842 1906. May. ‡Llewellyn, Daniel, 33, *King Edward Street, Blaengarn, near Bridgend.*

3843 1906. May. ‡Mantell, Ernest, *The Council House, Sparkhill, near Birmingham*

3844 1906. May. Raw, Miss May Adeline, 21, *Gassiott Road, Tooting, S.W.*

3845 1906. May. ‡Shannon, John Paterson, *Noblehill Mill, Dumfries, N.B.*

3846 1906. May. STOKES, Miss Nina Catherine, 11, *Oakley Street, Chelsea, S.W.*
3847 1906. May. ‡SWANN, Miss Esther, 25, *Chelsea Road, Brincliffe, Sheffield.*
3848 1906. May. ‡YOUNG, Mrs. Annie Catherine, 70, *Sisters Avenue, S.W.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

Adams, *Prof. H., M.Inst.C.E.* Cassell's Building Construction, comprising Notes on Materials, Processes, Principles, and Practice, including about 2,300 Engravings and 12 Plates. 552 pp., 8vo. London, 1906. *The Author.*

Bern. Statistiches Jahrbuch der Schweiz Herausgegeben vom statistischen Bureau des eidg, Departements des Tunern. Vierzehnter Jahrgang, 1905. 355 pp., 8vo. Bern, 1906. *The Bureau de Statistique.*

Chilvers, *G. W., F.R.Met.Soc.* Meteorology in its bearing on Sanitary Science and Engineering. 15 pp., 8vo. London, 1906. *The Author.*

Georgetown. Town Superintendent's Annual Report, 1905. 21 pp., fcp. Georgetown. 1906. *Luke M. Hill, M.Inst.C.E.*

Greenwich Royal Observatory. Results of the Magnetical and Meteorological Observations made in the Year 1903, under the direction of W. H. M. Christie, C.B., M.A., D.Sc., F.R.S., Astronomer Royal. 236 pp., 4to. London, 1906. *The Astronomer Royal.*

Hoskyns-Abrahall, *W.* The Health Reader. 277 pp., 8vo. London, 1906. *Cassell & Co., Ltd. (Publishers).*

Kuborn, *M. le Dr. Prof. Hyac.* Aperçu Historique sur l'Hygiène Publique en Belgique depuis 1830. Deuxième édition. 336 pp., 8vo. Bruxelles, 1904. *The Author.*

Lanark County Council. Report by the Medical Officer of Health on School Hygiene Administration. 44 pp., 8vo. Hamilton, 1906. *J. T. Wilson.*

Lemmoin-Cannon, *H.* Modern Sewage Disposal. A Popular Handbook; being a brief and simple outline of the principal methods which have been, and are, employed to deal with the sewage of communities. 104 pp., 8vo. London, 1906. *The Author.*

Local Government Board. Dr. G. S. Buchanan's Report on Administration in London with regard to Meat of Pigs affected by Tuberculosis. No. 225. 60 pp., fcp. London, 1906. *G. S. Buchanan, M.D. B.Sc.*

——— Dr. R. J. Reece's Report on the Epidemic of Enteric Fever in the City of Lincoln, 1904–5. No. 226. 57 pp., fcp. London, 1906.

——— Dr. S. W. Wheaton's Report on the Sanitary Circumstances and Sanitary Administration in the Abertillery Urban District. No. 228. 9 pp., fcp. London, 1906.

——— Dr. J. Spencer Low's report upon an outbreak of enteric fever at Sutton Bonnington, in the Leake Rural District, Nottinghamshire (No. 227). 7 pp. fcap. London, 1906.

——— Dr. S. Monckton Copeman's report on an outbreak of enteric fever at Fulbourn Asylum, near Cambridge, with special reference to risk of pollution of underground water supplies by the sewage of the Asylum (No. 229). 20 pp., fcap. London, 1906.

Local Government Board. Dr. S. Monckton Copeman's report on an investigation into the general sanitary circumstances of the Langport Rural District, with special reference to the occurrence there of outbreaks of diphtheria and smallpox (No. 230). 19 pp., fcap. London, 1906. *W. H. Power, C.B., F.R.S.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, February, 1906 .. .. *Matthew Hay, M.D.*
Bath, 1905 .. .. *W. H. Symons, M.D., D.P.H.*
Aberdeen, March, 1906 . .. *Matthew Hay, M.D.*
Aberdeen (San. Inspector's), 1905 .. *K. Cameron.*
Bexhill, 1905.. .. .. .. *O. Osborne, M.R.C.S., L.R.C.P.*
Birmingham, 1905 (Public Analyst). *J. F. Liverseege, F.I.C., Ph.C.*
Blackburn (Education Committee), 1905 .. .. *A. Greenwood, M.D., D.P.H.*
Blackpool, 1905 .. .. .. *F. J. H. Coutts, M.D., D.P.H.*
Bourne, 1905.. .. .. .. *J. W. Burdwood, L.S.A., M.O.H.*
Bridlington, 1905 .. .. .. *A. Forrest, M.B., C.M.*
Brighton, 1905 .. .. .. *A. Newsholme, M.D., F.R.C.P.*
Bucklow R.D., and **Knutsford**, **Middlewich**, **Winsford**, and **Biddulph Urban Districts**, 1905 .. .. *T. W. H. Garstang, M.R.C.S., D.P.H.*
Chesterfield. 1905 .. .. .. *H. Peck, M.D., D.P.H.*
Clayton-le-Moors, 1905 .. .. *C. H. Tattersall, L.R.C.P., M.R.C.S.*
Crewe, 1905 .. .. *A. J. Laird, M.D., D.P.H.*
Darwen, 1905 .. .. .. *F. G. Haworth, M.D., C.M., D.P.H.*
East Ham, 1905 .. .. .. *G. Sowden, M.D., D.P.H.*
Eccles, 1905 .. .. *W. M. Hamilton M.D., D.P.H.*
Edinburgh, 1905 (Burgh Engineer's). *J. Massie, Burgh Engineer.*
Exeter, 1905 . .. . *E. A. Brash, L.R.C.P.Lond.*
Failsworth, 1905 .. .. .. *G. S. Leslie, M.B., C.M.*
Harrow-on-the-Hill, 1905 .. .. *J. Fletcher Little, M.B., M.R.C.P.*
King's Norton & Northfield, 1905.. *R. Green, M.D., D.Hy., D.P.H.*
London (City of), four weeks ending 17th March, and four weeks ending 14th April, 1906 .. .. .. *W. Collingridge, M.A., M.D., D.P.H.*
Longton, 1905 .. .. .. *J. W. Dawes, M.B., C.M.*
Mid-Lothian C.C. (San. Inspector's), 1905 .. .. *R. Lindsay.*
New Windsor, 1905.. .. .. *E. Casey, M.O.H.*
Nuneaton and **Chilvers Coton**, 1905. *E. Peacock, M.R.C.S., L.S.A.Lond.*
Penge (Sanitary Inspector's), 1905 .. *A. J. Willett.*
Southport, 1905 .. .. .. *J. J. Weaver M.R.C.S., D.P.H.*
Stoke Newington, 1905 .. .. *H. R. Kenwood, M.B., L.R.C.P., D.P.H.*
Swindon, 1905 .. .. .. *F. E. Streeten, D.P.H.*
Tyne Port Sanitary Authority, 1905 *W. E. Harker, M.D., D.Hy.*
Wigan, 1905.. .. .. .. *W. Berry, F.R.C.S.I., D.P.H.*
Wimbledon, 1905 .. .. .. *E. Pocklington, M.R.C.S., M.O.H.*

Ontario. Report relating to the Registration of Births, Marriages, and Deaths for the year ending 31st December, 1903. 8vo. Toronto, 1905.
W. J. Hanna, Registrar-General of Ontario.

Providence, R.I. The Butler Hospital: Reports of the Trustees and Superintendent, presented to the Corporation at its Sixty-second Annual Meeting, Jan. 24th, 1906. 44 pp., 8vo. Providence, 1906.
G. Alder Blumer, M.D., L.H.D.

Registrar-General. Sixty-seventh Annual Report of Births, Deaths, and Marriages in England and Wales, 1904. 335 pp., 8vo. London, 1906.
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Richardson, *B. W., M.D., F.R.S.* Hygeia: a City of Health. A Presidential Address delivered before the Health Department of the Social Science Association at the Brighton Meeting, 1875. 47 pp., 8vo. London, 1876.
Purchased.

Salisbury (Rhodesia). Minute of His Worship the Mayor for the Year ending 3rd August, 1905. 27 pp., fcp. Salisbury, 1906. *J. P. Horsfield, M.R.San.I.*

Smith, *E. M., M.D., D.P.H.* A Criticism of the Midwives Act, 1902. 12 pp., 8vo. Bristol, 1906. *The Author.*

Wood, *F., M.Inst.C.E., F.G.S.* Sanitary Engineering: a Practical Manual of Town Drainage and Sewage and Refuse Disposal. Second Edition. 290 pp., 8vo. London, 1906. *Chas. Griffin & Co., Ltd. (publishers).*

GENERAL NOTE.

An International Hygienic Exhibition was opened on May 12th in Vienna, and will continue till the 15th of July.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	116	8	0

Contributions since last report.

Miss M. G. M. Shickle		10	6
Miss Alice Wadmore		10	6

May 24th, 1906.

THE

TWENTY-THIRD CONGRESS,

1906,

WILL BE HELD AT

BRISTOL,

From JULY 9th to 14th.

GENERAL ARRANGEMENTS.

ADDRESSES AND LECTURES.

President's Inaugural Address.

Lecture to the Congress.

Popular Lecture.

SECTIONS.

A.—Section I. Sanitary Science and Preventive Medicine.

B.—Section II. Engineering and Architecture.

C.—Section III. Chemistry, Physics, and Biology.

CONFERENCES.

D.—Of Municipal Representatives.

E.—Of Medical Officers of Health.

F.—Of Engineers and Surveyors to County and Sanitary Authorities.

G.—Of Veterinary Inspectors.

H.—Of Sanitary Inspectors.

J.—Of Women on Hygiene.

K.—On the Hygiene of School Life.

EXHIBITION.

An Exhibition of Apparatus and Appliances relating to Health and of Domestic use will be held in connection with the Congress.

PAPERS AND DISCUSSIONS.

The Council invite Papers on subjects relating to Health and Sanitary Science. Papers are limited to about 3,000 words. Accepted

papers are, as far as possible, printed and distributed in the Reception Room before they are discussed, and at the Meeting they are taken as read. Authors are allowed five minutes to introduce the main arguments of the paper before the discussion begins. A short abstract must accompany every Paper, both for the convenience of the Press at the Congress and for insertion, subject to the approval of the Council, in the Journal of the Institute, should it not be deemed desirable to publish the paper *in extenso*. No previously published Paper can be accepted. The acceptance of Papers, and the days on which they are to be discussed, are determined by the Council before the beginning of the Meeting, and published in the Daily Programmes, obtainable in the Reception Room. The Council reserve the right of refusing any Papers sent in; and in the case of those accepted, the discussion of them must depend on the time at the disposal of the Meeting. Papers accepted for the Congress cannot be published by the Authors, except by permission of the Council. The Council reserve to themselves the privilege of printing any Paper, either wholly or in part, or of refraining from the publication thereof, if they see fit.

Authors should forward their manuscript by post *as early as possible, and in any case not later than June 9th,* addressed to the Secretary, Royal Sanitary Institute, Margaret Street, London, W.

RESOLUTIONS.

Resolutions put from the Chair at the Meetings must only be in the form of recommendations to the Council of the Institute, by whom all such recommendations will be carefully considered. The number of persons present, and the proportions voting, must be recorded by the Chairman for the information of the Council.

No Resolution can be proposed at any of the Sections or Conferences, unless *sent to the Secretary of the Section or Conference in time for approval and insertion in the Programme for the day on which it is to be proposed.*

No Resolutions can be put to a Meeting unless, in the opinion of the President (or Chairman for the time being), the Section is adequately represented.

RECEPTION ROOM AND PLACES OF MEETING.

A Reception Room will be opened at THE VICTORIA ROOMS, on MONDAY, JULY 9TH, at NOON, and on the following days at 9 A.M. till 4 P.M., for the issue of all Tickets in connection with the Congress. The Reception Room will be available for Reading, Writing, and Conversation.

The Inaugural Address of the President, the Lecture to the Congress, and the Popular Lecture will be given in THE VICTORIA ROOMS.

The Sectional Meetings, General Meetings, and Conferences will be held in THE VICTORIA ROOMS, UNIVERSITY COLLEGE, and THE BLIND ASYLUM.

The Exhibition will be held in THE VOLUNTEER DRILL HALL, Queen's Road.

HOTEL AND LODGING ACCOMMODATION, AND TRAVELLING ARRANGEMENTS

Will be determined by the Local Committee, and information relating to the same may be obtained from the Local Secretary, and from the Secretary of the Institute.

TICKETS.

Fellows, Members, and Associates of the Institute, are supplied with Tickets for the Congress on application to the Secretary before the Congress, or may be obtained at the Reception Room during the Meeting.

To those not connected with the Institute, Congress Tickets will be issued, entitling the holder to the use of the Reception Room, to admission to the Presidential and other Addresses, to all Meetings, to the Exhibition of the Institute, to any Conversazione given by the Institute, and copies of the Monthly Journal of the Institute containing the proceedings of the Congress. The price of the Congress Tickets is £1 1s. each. Ladies' Tickets (not including copies of the Proceedings), 7s. 6d. each. These Tickets may be obtained up to Thursday, July 5th, at the Office of the Local Secretary at Carlton Chambers, Baldwin Street, Bristol, or at the Offices of The Institute, 72, Margaret Street, London, W., and on July 9th and following days between 9 a.m. and 4 p.m. at The Victoria Rooms.

EXCURSIONS.

Particulars of these will be published in the local Programme, and Tickets and List of Places to be visited can be obtained at the Reception Room during the Meeting.

RAILWAY ARRANGEMENTS.

The Railway Companies have decided to issue return Tickets to Bristol at a single fare and a quarter, available from July 5th to the 23rd. Certificates necessary to obtain this reduction will be supplied with Congress Tickets. Return Tickets at a single fare and a quarter for the double journey will be issued to members of the Congress, on production of their Congress Tickets, from Bristol to stations not more than fifty miles distant—(minimum charge 1s.).

Officers of the Congress.

President.

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RISELEY, Miss.
ROBINSON, EDWARD, J.P., City Councillor.
ROBINSON, Mrs. EDWARD.
ROBINSON, F. E.
RODWAY, E. G., A.R.I.B.A.
ROWLEY, C. A.
ROGERS, B. M. H., M.D.
SAVERY, F., A.R.S.I.
SCULL, A. S.
SEWELL, Rev. A. H., M.A.
SHEPPARD, E. J., L.R.C.P.
SHEPPARD, F., City Councillor.
SHIRLEY, SAMUEL, City Councillor.
SHOVE, F.
SILCOCK, T. R., M.P., B.SC., F.S.I.
SINNOTT, E. S., M.I.C.E.
SKERRITT, E. MARKHAM, M.D., F.R.C.P.
SKINNER, W. S.
SMITH, HAROLD, A.R.I.B.A.
SMITH, R. SHINGLETON, M.D., F.R.C.P.
SMITH, Rev. S. BOYTON, M.A.
SMITH, S., Surg. Lt.-Col. M.R.C.S., L.S.A., V.D.
SMYTH, Lady GREVILLE.
SQUIRE, W. W., M.I.C.E., President, Bristol Society of Engineers.
STANDERWICK, G.
STEELE, W. J., A.M.I.C.E., Deputy City Engineer.
STEELE, C. M.D., F.R.C.S., L.R.C.P.
STEWART, J., B.A., F.R.C.P.
STODDART, F. WALLIS, F.I.C., F.C.S.
STREET, E. E., C.E.
STROUD, Councillor J. S. G. W.
STUART, D. M. D., C.E., F.G.S.
STURGE, F.
SWAISH, Alderman J., J.P.
SYMES, J. O., M.D., D.P.H., M.R.C.S., L.R.C.P.
TARR, H. C. H.
TAYLOR, E. J., the Town Clerk of Bristol.
TERRETT, Alderman.
TETLEY, Rev. Canon, D.D.
THICKLE, Miss MABEL.
THOMAS, CHARLES, J.P.
THOMAS, C. L., A.R.SAN.I.
THOMAS, W. K., A.R.SAN.I.
THOMPSON, C. E.
THORNE, C. J., City Councillor.
TIVY, W. J., F.R.C.P., F.R.C.S.E.

LOCAL GENERAL COMMITTEE—*continued.*

TOWNSEND, Miss F. MARION.
TRAVERS, Professor MORRIS W., D.SC., F.R.S.
TREBILCO, Rev. J.
TREBILCO, Mrs., M.A.
TUKE, Miss M., M.A.
TYNDALL, A. M., B.SC.
TREW, A. R. F.
TRIBE, A. G. N.
TYACK, E. C., Chairman Board of Guardians.
TYRRELL, E. G.
TYRRELL, M. E. G.
VACHELL, Miss A.
WAIT, Miss M. S. K.
WALKER, C. H., M.B., F.R.C.S.
WATERFALL, C. J., F.I.C., F.C.S.
WATKINS, W. H., A.R.I.B.A.
WATTS, NICHOLAS, A.M.I.C.E.
WEIR, PRESTON, B.A., F.J.I.
WELLS, CHARLES.
WERTHEIMER, Prof. J., B.SC., B.A., F.I.C., F.C.S.
WEST, Rev. J. O., M.A.
WETHERED, E. H. C., B.A., LL.B.
WHICHER, A. H., M.R.C.S., L.S.A.
WHITE, Sir GEORGE, Bart., J.P.
WHITE, Lady.
WHITE, SAMUEL, J.P.
WIGAN, C., M.D., J.P., Chairman, Portishead Urban District Council.
WILKINS, A. E., A.R.SAN.INST.
WILKINS, Rev. H. J., M.A.
WILLIAMS, HENRY.
WILLIAMS, J. L. V. SEYMOUR, Gloucestershire County Council
WILLIAMS, P. WATSON, M.D.
WILLS, Sir FREDERICK, Bart.
WILLS, H. A. S.
WILLS, W. K., M.A., M.B., B.C.
WILSON, F., A.M.I.C.E.
WINKWORTH, Miss A. E.
WINTERSTOKE, Lord.
WINTLE, COLSTON, M.R.C.S., L.R.C.P.
WISE, W. H., Assistant Town Clerk.
WOODCOCK, H. C., City Councillor.
WORTH, J., City Councillor.
WRIGHT, JOHN A., C.E.
YABBICOM, T. H., M.I.C.E., City Engineer.
YOUNG, J. S., M.D.

Executive Committee.

Chairman—Councillor COLSTON WINTLE. *Vice-Chairman*—Alderman G. PEARSON

THE RT. HON. THE LORD MAYOR OF BRISTOL.
THE HIGH SHERIFF OF BRISTOL.
ABRAHALL, Miss HOSKYNS.
ADAMS. W. AVERY, Secretary to the Bristol Education Committee.
ADDIE. PETER, F.S.I., City Valuer.
ASHMAN, SIR HERBERT, J.P.
ASHMAN, LADY.
BAKER, JAMES, F.R.G.S.
BARON, J. BARCLAY, M.B., C.M.
BERNARD, W. L., F.R.I.B.A.
BILLING, Counc. C. P.
BIRRELL, Mrs. AUGUSTINE.
BISHOP, GEORGE. M.R.C.V.S.
BOLTON. H., F.R.S.E.
BOUCHER, C. E., B.SC.
BOUTFLOWER, C. E. D.
BOYD, J., J.P.
BRASHER, C. W. J., L.R.C.P., M.R.C.S.
BRACHER, W. S., M.R.SAN.I.
BRICKDALE, FORTESCUE, M.D., M.R.C.P.
BRYAN, H. DARE, F.R.I.B.A.
BULLEN, F. ST. JOHN, M.R.C.S.
BURNS Miss.
BURRIS, F., J.P.
BUSH, J. PAUL, C.M.G.
BUTLER, THOS., J.P.
CADE, W. J., M.R.C.V.S.
CARTER, T. M., L.R.C.P., M.R.C.S.
CAVE, C. H., Councillor, J.P.
CHARLES, J. R., M.D., M.R.C.P.
CHATTOCK, H. E.
CHURCHILL, Rev. S., M.A.
CLARKE, J. MICHELL, M.A., M.D.
CLARKE, W. SEFTON, B.A.
CLEVERDON, T.
CLIFFORD, Miss MARY.
COCKS, Miss E. A.
COLBORNE, F. NEWTON.
COOK, E. H., D.SC., F.I.C., F.C.S.
COOPER, Rev. W. B., M.A.
COTTERELL, A. P. I., M.I.C.E.
COWARD, H., F.R.I.S.
COWPER-COLES, S. H., F.S.I.
CRISPIN, GEO.
CROMPTON, JAS.
CURLE, Alderman J., J.P.
DARNELL-SMITH, G. P., B.Sc., F.I.C., F.C.S.
DAVID, Rev. A. A., M.A.
DAVIES, Mrs. HOWELL.
DAVIES, D. S., M.D., D.P.H.
DE JERSEY, Rev. NORMAN S.
DOGGETT, H. G.
DUNBAR, ELIZA WALKER, M.D.
DYKE, THOS., M.I.C.E., B.A., J.P.
DYER, E. M.
EBERLE, EMILY E., M.B., F.R.C.S.
ELKINS, W. H., City Councillor, J.P.
ELLIOTT, C. H. B.
FAWCETT, Prof. EDWD., M.B.
FERRIER, Prof. R. M., M.SC., B.SC., M.I.C.E.
FINN, ANTHONY, M.A., LL.D.
FLETCHER, J., M.D., D.P.H.
FORTEY, Miss E. C., B.Sc.
FOSTER, THOMAS S., M.A.
FRANCIS, E. FRANCIS, Prof. D.SC., PH.D., F.I.C.
FROUD, MAYNARD.
GANE, P. E., Councillor.
GARDNER, Alderman C. E. L., J.P.
GIBBS, Mrs. G. A.
GOUGH, W. V.
GRANT, Miss JANET.
GREENSLADE. W. A.
HAILES. CLEMENT, M.D., F.R.C.S.
HALL, Professor I. WALKER, M.D.
HAYES, C. A., Councillor.
HAYMAN, C. A., M.D., J.P.
HEAVEN, J. C., L.R.C.P., M.R.C.S., L.S.A., D.P.H.
HISCOX, T. J.
HOBHOUSE, Mrs. C. E. H.
HOWELL, J. H., J.P.
HOYMAN, Mrs. C. A.
HUGHES, Miss E. M., B.A.
IRVING, D. L., M.I.C.E.
JACKSON, ROBERT.
JAMES, Dr., PH.D.
JAMES, R. C., A.R.I.B.A.
JARMAN. Rev. G.
JOHNSON, Miss THEODORA.
JONES, HOWARD, M.D., D.SC., M.O.H.
JOSE, W. W., J.P.
KANE, JAMES.
KENT, Prof. STANLEY, M.A., F.L.S., F.G.S.
KIRLEY, J. W.
LANE, J. TREMAYNE.
LANGFIELD, A. A. LEVY.
LANGLANDS, A.
LEIGH, FRANK, F.R.C.V.S.
LENNARD, T. J., J.P.
LENNARD, Mrs. T. J.
LINDREA, T. T., J.P.
LINTON, MARION S., B.A., M.B.
LLEWELLIN, W. M., C.E.
LOWE, Alderman C. J., J.P.
MATHEWS, E. R. NORRIS.
MORGAN, Prof. C. LLOYD, LL.D., F.R.S.
MOSS-FLOWER, T. J., ASSOC.M.INST.C.E., F.G.S.
MOXEY. S. G.
MUNRO, P., M.S.A., F.S.I.
NEILD, NEWMAN, M.B.
OATLEY, G. H., F.R.I.B.A.
O'BRIEN, C., L.R.C.P., L.R.C.S.
ORMEROD, H. L., M.D.
PAUL, W. S., J.P.
PAULI, G. C., M.R.C.S., L.R.C.P.
PEAKE, A. W., L.R.C.P., M.R.C.S.
PEAKE. F. E., L.R.C.P., M.R.C.S.
PEARCE. A., A.M.I.C.E.
PEARSON, Alderman G.
PHELPS, Rev. P. A., M.A.
PINKNEY, J. D. H., A.R.SAN.I.
POWELL, A., M.I.C.E.
PRITCHARD, A. W., M.R.C.S., L.S.A.
PRITCHARD, JOHN E., F.S.A.
PROCTOR, H. FARADAY, A.M.I.C.E., M.I.E.E.
RISELEY, Miss.
ROBINSON, EDWARD, J.P.
ROBINSON, Mrs. EDWARD.
SCULL, A. S.
SEWELL, Rev. A. H., M.A.
SHEPPARD, E. J., L.R.C.P., L.R.C.S.
SHEPPARD, F., City Councillor.
SILCOCK, T. B., M.P., B.SC., F.S.I.
SINNOTT, E. S., M.I.C.E.
SKERRITT, E. MARKHAM, M.D., F.R.C.P.
SKINNER, W. S.
SMITH-BOYTON, Rev. S., M.A.
SMITH, HAROLD, A.R.I.B.A.
SMITH, R. SHINGLETON, M.D., F.R.C.P., M.R.C.S., L.S.A.
SMYTH, Lady GREVILLE.
STEELE, W. J., A.M.I.C.E.

EXECUTIVE COMMITTEE—*continued.*

STODDART, F. WALLIS, F.I.C., F.C.S.
STREET, E. E., C.E.
STUART, D. M. D., C.E., F.G.S.
STURGE, F.
SYMES, J. O., M.D., D.P.H.
The LADY MAYORESS.
TAYLOR, F. J., The Town Clerk of Bristol.
TETLEY, Rev. Canon, D.D.
THICKLE, Miss MABEL.
THOMAS, W. K., A.R.SAN.I.
TOWNSEND, Miss F. MARION.
TRAVERS, Professor MORRIS W., D.SC., F.R.S.
TREBILCO, Rev. J.
TREBILCO, Mrs. M.A.
TREW, A. R. F.
TUKE, Miss M., M.A.
TYACK, E. C
TYNDALL, A. M., B.SC
TYRRELL, E. G.
VACHELL, Miss A.
WAIT, Miss M. S. K.
WALKER, C. H., M.B., F.R.C.S.
WATERFALL, C. J., F.I.C., F.C.S.
WATTS, NICHOLAS, A.M.I.C.E.
WEIR, PRESTON, B.A.
WELLS, CHARLES.
WHITE, SIR GEORGE, Bart., J.P.
WHITE, LADY.
WHITE, SAMUEL, J.P.
WILKINS, Rev. H. J., M.A.
WILLIAMS, HENRY.
WILLIAMS, P. WATSON, M.D.
WILSON, E. F., A.M.I.C.E.
WILLS, H. A. S.
WINKWORTH, Miss A. E.
WINTLE, COLSTON, M.R.C.S., L.R.C.P.
WISE, W. H.
WOODCOCK, H. C.
WRIGHT, J. A., C.E.
YABBICOM, T. H., M.I.C.E.

Finance Sub-Committee.

Chairman—Dr. T. M. CARTER. *Secretary*—JAMES CROMPTON.

BOUCHER, C. E.
BOUTFLOWER, C. E. D., Councillor.
BOYD, J., Councillor.
CARTER, Dr. T. M., Councillor.
CHATTOCK, H. E.
CROMPTON, JAMES.
DOGGETT, H. G.
GANE, P. E., Councillor.
HISCOX, T. J., Councillor.
LANGLANDS, A.
LEVY LANGFIELD, A. A., Councillor
MOXEY, S. G., Councillor.
STURGE, F.
WOODCOCK, H. C., Councillor.

And the Chairman and Vice-Chairman of the Executive Committee, as also the Treasurer and the Secretary *ex officio.*

Reception and Hospitality Sub-Committee.

THE RT. HON. THE LORD MAYOR OF BRISTOL.
THE LADY MAYORESS.
THE HIGH SHERIFF.
THE RT. REV. THE LORD BISHOP OF BRISTOL.
ASHMAN, SIR HERBERT.
ASHMAN, LADY.
BOUCHER, C. E.
BOYD, J., Councillor.
CARTER, T. M., Councillor, M.R.C.S.
CLARKE, W. SEFTON.
DAVID, Rev. A. A.
DAVIES, D. S., M.D.
DUNBAR, ELIZA WALKER, M.D.
FAWCETT, Professor EDWARD.
FERRIER, Professor R. M.
GANE, P. E., Councillor.
HAYMAN, CHAS., M.D.
HAYMAN, Mrs. C. A.
KIRLEY, J. W.
LENNARD, T. J.
LENNARD, Mrs T. J.
LINDREA, T. T., Councillor.
MORGAN, Professor C. LLOYD
PEARSON, G., Alderman.
RISKLEY, Miss.
ROBINSON, EDWARD.
ROBINSON, Mrs. EDWARD.
SHEPPARD, E. J., L.R.C.P.
SMITH, R. SHINGLETON, M.D.
TAYLOR, E. J.
THOMAS, CHARLES.
WISE, W. H.
YABBICOM, T. H.
WILLS, H. A. S.

And the Chairman of the Executive Committee, as also the Treasurer and the Secretary *ex officio.*

Excursions Sub-Committee.

Chairman—JAMES BAKER, F.R.G.S. *Secretary*—W. K. THOMAS.

ADDIE, PETER.
BAKER, JAMES.
BRACHER, W. S.
CHATTOCK. H. E.
CLEVERDON. T., Councillor.
DAVIES, D. S., M.D
FAWCETT, Professor EDWARD.
FROUD, MAYNARD.
HEAVEN, J. C., L.R.C.P., M.R.C.S., D.P.H.
LEIGH, FRANK, Councillor.
OATLEY, G. H., Councillor.
PRITCHARD, JOHN E.
SCULL, A. S.
THOMAS, W. K.
WATTS, NICHOLAS
YABBICOM, T. H., M.INST.C.E.

And the Chairman and Vice-Chairman of the Executive Committee, as also the Treasurer and the Secretary *ex officio.*

Literary and Press Sub-Committee.

Chairman—E. NORRIS MATHEWS. *Secretary*—A. LANGLANDS

BAKER, JAMES.
COOPER, Rev. W. B.
FERRIER, Professor R. M.
FORTEY, Miss E. C.
LANGLANDS. A.
SMITH, HAROLD.
TREBILCO, Rev. J.
TUKE, Miss M.
WATERFALL, C. J.
WATTS, NICHOLAS.
WELLS, C.

And the Chairman of the Executive Committee, as also the Treasurer and the Secretary *ex officio.*

Arrangements and Exhibition Sub-Committee.

Chairman—A. P. I. COTTERELL. *Secretary*—MAYNARD FROUD

ADDIE. PETER.
BOUTFLOWER, C. E. D., Councillor.
BRASHER, C. W. J., M.R.C.S.
BRACHER, W. S.
BOLTON, H.
BURRIS, F., Councillor.
DAVIES, D. S., M.D.
DE JERSEY, Rev. NORMAN S.
DUNBAR, ELIZA WALKER, M.D.
FROUD, MAYNARD.
HAYMAN, C. A., M.D.
HEAVEN, J. G., L.R.C.P., M.R.C.S., D.P.H.
HISCOX, T. J.
IRVING, D. L.
KIRLEY, J. W.
LEVY-LANGFIELD, A. A.
OATLEY, G. H., Councillor.
SCULL, A. S.
SMITH, Rev. BOYTON.
STUART, D. M. D.
TAYLOR, E. J.
TREW, A. H. F.
TYRRELL, E. G.
WRIGHT, J. A.
YABBICOM, T. H.

And the Chairman of the Executive Committee, as also the Treasurer and the Secretary *ex officio.*

The Governments, County Councils, Corporations, Local Authorities, and Societies who have up to the present appointed Delegates to the Congress.

Foreign Governments.

Portugal.

Government Departments (3).

The Admiralty.
Board of Education.
War Office.

Metropolitan Asylums Board.

County Councils (19).

Ayrshire.
Cardiganshire.
Cheshire.
Cumberland.
Durham.
Elgin.
Essex.
Glamorgan.
Kesteven.
Lanark.
Lanark (Upper Ward)
Monmouthshire.
Northampton.
Nottingham.
Ruthin.
Shropshire.
Somerset.
Staffordshire.
Worcestershire.

County Boroughs (37).

Bath.
Birkenhead.
Birmingham.
Bolton.
Bootle.
Bournemouth.
Bradford.
Burnley.
Burslem.
Cardiff.
Crewe.
Croydon.
Derby.
Dublin.
Eastbourne.
Glasgow.
Halifax.
Hanley
Huddersfield.
Lancaster.
Leicester.
Lincoln.
Middlesbrough.
Newcastle-on-Tyne.
Northampton.
Nottingham.
Rotherham.
Sheffield.
Southampton.
Southport.
South Shields.
Stockport.
Sunderland.
Warrington.
West Bromwich.
West Hartlepool.
Wolverhampton.

Metropolitan Boroughs (3).

Stepney
Stoke Newington.
Woolwich.

Urban District Councils or Sanitary Authorities (59).

Accrington.
Aston Manor.
Aldershot.
Altrincham.
Barnet.
Basingstoke.
Berwick-on-Tweed.
Bollington.
Bootle.
Bromsgrove.
Bromyard.
Burnham.
Cambridge.
Chepstow.
Coatbridge.
Colchester.
Congleton.
Dartford.
Devonport.
Dorchester.
Ealing.
Farnham.
Fenny Stratford.
Flint.
Folkestone.
Frome.
Gateshead.
Glossop.
Goole.
Helensburgh.
Heywood.
Ilkeston.
Kidderminster.
Lisburn.
Maidenhead.
Maidstone.
Maldon.
Malvern.
Margam.
Merthyr Tydfil.
Menai Bridge.
Newport (Mon.).
Normanton.
Reigate.
Richmond.
Southall-Norwood.
Stourbridge.
Stretford.
Swindon.
Tadcaster.
Teignmouth.
Trowbridge.
Truro.
Wembley.
Wallsend.
Wath-upon-Deane.
Wood Green.
Worthing.
Wrexham.

Rural District Councils (5).

Lydney. Stowminster. Truro. Wallingford. Warmley.

Port Sanitary Authorities and others (3).

Leicester Sewage Works and Farms Committee.
Ribble Joint Committee. West Riding of Yorkshire Rivers Board.

School Authorities (4).

Burton-on-Trent. Flintshire. Kesteven C.C.
West Riding C.C.

Societies (32).

Architectural Association.
British Medical Association.
Central Veterinary Medical School.
Charity Organisation Society.
Childhood Society.
Civil and Mechanical Engineers' Society.
Edinburgh Architectural Association.
Geological Society.
Incorporated Association of Municipal and County Engineers.
Institution of Civil Engineers.
Institute of Marine Engineers.
King's College (University of London).
Medical Society of London.
Royal Academy of Medicine, Ireland.
Royal Army Medical School.
Royal College of Physicians.
Royal College of Physicians, Ireland.
Royal College of Veterinary Surgeons.
Royal Counties Veterinary Medical Association.
Royal Institute of British Architects.
Royal Medical & Chirurgical Society.
Royal Philosophical Society of Glasgow.
Royal University of Ireland.
Rural Housing and Sanitation Association.
Society of Architects.
Surveyors' Institution.
University College of South Wales and Monmouthshire.
University College, London.
University of Durham College of Medicine.
University of Glasgow.
University of Manchester.
University of Oxford.

Proceedings of the Congress and Officers of Sections and Conferences.

Reception of the Members and Delegates in the Council House, *Monday, July 9th, at 12.30 p.m.*
BY THE RIGHT HON. THE LORD MAYOR (A. J. SMITH, J.P.).

Public Luncheon in the Royal Hotel, *at 1.30 p.m.*

Opening of the Exhibition, *at 3 p.m.*
BY THE RIGHT HON. THE LORD MAYOR.

Reception of the Members and Delegates in the Victoria Rooms, *7—8 p.m.*
BY THE HIGH SHERIFF (H. H. RISELEY) AND MISS RISELEY.

Inaugural Address to the Congress, *at 8 p.m.*
BY THE RIGHT. HON. SIR EDWARD FRY, P.C., B.A., D.C.L., LL.D., F.R.S., F.S.A., F.L.S.

Lecture to Congress, *Wednesday, July 11th, at 8 p.m.*
"RELATION OF HEREDITY TO PHYSICAL DEGENERATION."
BY PROF. C. LLOYD MORGAN, LL.D., F.R.S.,
Principal of University College, Bristol.

Conversazione, and Reception in the Art Gallery, *Thursday, July 12th, at 8 p.m.*
BY THE RIGHT HON. THE LORD MAYOR.

Popular Lecture, *July 13th, at 8 p.m.*
BY COUNCILLOR W. F. ANDERSON, J.P.,
Chairman of the Glasgow Health Committee.

Garden Parties and visits to places of interest.
For time and places of all Meetings see page 107.

SECTIONAL MEETINGS.

Sect. 1.—"Sanitary Science & Preventive Medicine."

July 10th and 11th, to be held in THE VICTORIA ROOMS.

President.
SIR WILLIAM J. COLLINS, M.D., F.R.C.S., B.SC., D.P.H., J.P., M.P.

Vice-Presidents.

BARON, BARCLAY, J., M.B., C.M.
BULLEN, F. ST. JOHN, M.R.C.S., L.S.A.
BUSH, J. PAUL, C.M.G.
CLARKE, J. MICHELL, M.A., M.D., F.R.C.P.
DAVIES, D. S., M.D., M.O.H.
FLETCHER, JAMES, M.D., D.P.H.
HALL, Prof. I. WALKER, M.D.
KENT, Prof. A. F. STANLEY, M.A., F.L.S., F.G.S.
SKERRITT, E. MARKHAM, M.D., F.R.C.P.
SMITH, H. SHINGLETON, M.D., F.R.C.P.
SYMES, J. ODERY, M.D., D.P.H.
WINTLE, COLSTON, M.R.C.S., L.R.C.P.

Secretaries.
NEWMAN NEILD, M.B. | J. R. CHARLES, M.D., M.R.C.P.

Recording Secretary.
PROF. HENRY R. KENWOOD, M.B., D.P.H., LONDON.

Section II.—"Engineering and Architecture."

July 11th and 12th, to be held in THE UNIVERSITY COLLEGE.

President.

EDWIN T. HALL, V-P.R.I.B.A.

Vice-Presidents.

BLIGH-BOND, F., F.R.I.B.A.
BRYAN, H. DARE, F.R.I.B.A.
COTTERELL, A. P. I., M.INST.C.E.
FERRIER, Prof. R. M., M.SC, B.SC., M.INST.C.E.
GOUGH, W. V.
IRVING, D. L., M.I.C.E.
MOSS-FLOWER, T. J., ASSOC.M.INST.C.E., F.G.S.
OATLEY, G. H., F.R.I.B.A.
PROCTOR, FARADAY, A.M.I.C.E., M.I.E.E.
SILCOCK, T. B., B.SC., F.S.I., M.P.
YABBICOM, T. H., M.INST.C.E.

Secretaries.

NICHOLAS WATTS, A.M.I.C.E. | W. S. SKINNER.

Recording Secretary.

JOHN EDWARD WORTH, M.INST.C.E., LONDON.

Section III.—"Physics, Chemistry, and Biology."

July 12th and 13th, to be held in THE BLIND ASYLUM.

President.

W. N. SHAW, M.A., D.SC., F.R.S.

Vice-Presidents.

COOK, E. H., D.SC., F.I.C., F.C.S.
FAWCETT, Prof. EDWARD, M.B., C.M.
DARNELL-SMITH, G. P., B.SC., F.I.C., F.C.S.
STODDART, F. WALLIS, F.I.C., F.C.S.
TRAVERS, Prof., MORRIS W., D.SC., F.R.S.
WERTHEIMER, Prof. J., B.A., B.SC., F.I.C. F.C.S.

Secretaries.

PROF. F. E. FRANCIS, D.SC., PH.D., F.I.C. | A. M. TYNDALL, B.SC.

Recording Secretary.

LIEUT.-COL. R. H. FIRTH., R.A.M.C., F.R.C.S., D.P.H., FARNBOROUGH.

CONFERENCES.

Municipal Representatives.

Tuesday, July 10th, to be held in THE UNIVERSITY COLLEGE.

President.

COUNCILLOR COLSTON WINTLE, M.R.C.S.,
Chairman of Health Committee, City of Bristol.

Vice-Presidents.

The Rt. Worshipful The MAYOR OF BATH.
The Worshipful The MAYOR OF BRIDGWATER.
The Rt. Hon. The LORD MAYOR OF CARDIFF.
The Worshipful The MAYOR OF CHIPPENHAM.
The Worshipful The MAYOR OF CHELTENHAM.
The Worshipful The MAYOR OF GLOUCESTER (Councillor George Peters)
The CHAIRMAN OF THE COUNTY COUNCIL OF GLOUCESTER.
The Worshipful The MAYOR OF NEWPORT.
The CHAIRMAN OF THE WESTON-SUPER-MARE URBAN DISTRICT COUNCIL.
HOBHOUSE, HENRY, M.P., Chairman of the County Council of Somerset.
The CHAIRMAN OF THE COUNTY COUNCIL OF WILTSHIRE.

Secretaries.

EDMUND J. TAYLOR, Town Clerk, Bristol. | W. H. WISE.

Recording Secretary.

PHILIP BOOBBYER, M.D., NOTTINGHAM.

This Conference is open to all Members and Officials of Municipal Bodies.

Medical Officers of Health.

Thursday, July 12th, to be held in THE UNIVERSITY COLLEGE.

President.

D. S. DAVIES, M.D., D.P.H., Medical Officer of Health, Bristol.

Vice-Presidents.

ALFORD, H. J., M.D.
BOND, F. T., M.D., B.A.LOND., F.R.S.E.
BRASH, E. A., L.R.C.P., M.R.C.S.
CHALMERS, A. K., M.D., D.P.H.
DAVIES, E., M.R.C.S.
HOWARD-JONES, M.D., B.SC.
HOPE, W. M., D.P.H.
JONES, HERBERT, D.P.H.
MARTIN, J. MIDDLETON, B.A., M.D., D.P.H.
MOORE, H. CECIL, M.R.C.S.
NEALE, G., L.R.C.P., L.R.C.S., J.P.
NIVEN, J., M.A., M.B.
PRICHARD, R., M.D., C.M., D.P.H.
SYMONS, W. H., M.D., M.R.C.S., L.R.C.P., D.P.H.
THOMAS, J. TUBB, L.R.C.P., L.R.C.S., D.P.H.
WALFORD, E., M.D., D.P.H.
WILLIAMS, F. M., L.R.C.P., M.R.C.S., D.P.H.
WILLIAMS, W., M.A., M.B., D.P.H., M.R.C.S.

Secretaries.

J. C. HEAVEN, L.R.C.P., M.R.C.S., D.P.H. J. HOWARD-JONES, M.D., D.SC.

Recording Secretary.

A. WELLESLEY HARRIS, M.R.C.S., D.P.H., LEWISHAM.

This Conference is open to all Medical Officers of Health

Engineers and Surveyors to County and other Sanitary Authorities.

Tuesday, July 10th, to be held in THE BLIND ASYLUM.

President.

H. PERCY BOULNOIS, M.INST.C.E.,
Engineering Inspector, Local Government Board.

Vice-Presidents.

ADYE, C. S., F.S.I.
BELL, G., ASSOC M.INST.C.E.
DAVIS, A. T., M.INST.C.E.
HARPUR, W., M.INST.C.E.
HAYNES, R. H.
LEMON, J., M.INST.C.E.
MATTHEWS, W., M.INST.C.E.
NETTLETON, H., ASSOC.M.INST.C.E.
PHILLIPS, R., ASSOC.M.INST.C.E.
PICKERING, J. S., M.INST.C.E.
READ, R., ASSOC.M.INST.C.E.
WILLCOX, W. J., F.R.I.B.A.

Secretaries.

T. H. YABBICOM, M.INST.C.E. | A. P. I. COTTERELL, M.INST.C.E.

Recording Secretary.

E. G. MAWBEY, M.INST.C.E., LEICESTER.

This Conference is open to all Municipal and County Engineers.

Veterinary Inspectors.

Friday, July 13th, to be held in THE UNIVERSITY COLLEGE.

President.

FRANK LEIGH, F.R.C.V.S.

Vice-Presidents.

BLUMSOME, W., M.R.C.V.S.
DAVIES, D. G., M.R.C.V.S.
ELDER, G. H., M.R.C.V.S.
HUBAND, THOMAS A., F.R.C.V.S.
JERMYN, W. B., M.R.C.V.S.
PARR, G., M.R.C.V.S.
PENBERTHY, Prof J., M.R.C.V.S.
STEWART, A. C., M.R.C.V.S.
WELCH, W. A., M.R.C.V.S.

Secretaries.

W. J. CADE, M.R.C.V.S. | GEORGE BISHOP, M.R.C.V.S.

Recording Secretary.

W. HUNTING, F.R.C.V.S., LONDON.

This Conference is open to all Members of the Veterinary Profession.

Sanitary Inspectors.

Wednesday, July 11th, to be held in THE MUSEUM LECTURE THEATRE.

President.

A. E. HUDSON, Chief Sanitary Inspector, Cheltenham.

Vice-Presidents.

ADDISCOTT, A. J.
ANDERSON, GEO. H.
BOTTOMLEY, A. E.
DIMOND, S. O.
JONES, SPENCER E.
LOWTHER, T.
McMAHON, CHARLES.
WEST, W. W.
WREFORD, W. J.

Secretaries.

W. A. CRAVEN. | J. W. KIRLEY.

Recording Secretary.

ISAAC YOUNG, BATTERSEA.

This Conference is open to all Sanitary Inspectors and Inspectors of Nuisances.

Women on Hygiene.

Thursday, July 12th, to be held in THE VICTORIA ROOMS.

President.

HER GRACE THE DUCHESS OF BEAUFORT.

Vice-Presidents.

The LADY MAYORESS.
ASHMAN, LADY.
SMYTH, Lady.
BIRRELL, Mrs. AUGUSTINE.
BURNS, Miss.
CLIFFORD, Miss MARY.
COCKS, Miss E. A.
DAVIES, Mrs. HOWELL.
DUNBAR, ELIZA WALKER, M.D.
EBERLE, EMILY E., M.D.
GIBBS, Mrs. G. A.
HAYMAN, Mrs. C. A.
HOBHOUSE, Mrs. C. E. H.
HUGHES, Miss E. M., B.A.
LINTON, MARION S., M.B.
LINTON, Miss MARION, B.A., M.B.
RISELEY, Miss.
ROBINSON, Mrs. EDWARD.
TREBILCO, Mrs., M.A.
VACHELL, Miss.
WHITE, Lady.
WINKWORTH, Miss ALICE.

Secretaries.

MISS MARGARET TUKE, M.A. | MISS F. MARION TOWNSEND.

Recording Secretary.

MISS E. C. FORTEY, B.SC., BRISTOL.

This Conference is open to all Ladies interested in Domestic Hygiene.

The Hygiene of School Life.

Wednesday, July 11th, to be held in THE BLIND ASYLUM.

President.

THE RIGHT REV. THE LORD BISHOP OF HEREFORD.

Vice-Presidents.

ABRAHALL, Miss HOSKYNS.
CARTER, T. M., M.R.C.S., L.R.C.P.
COOK, E. H., D.SC., F.I.C., F.C.S.
COWARD, H., F.R.I.S.
DAVID, Rev A. A.
ELLIOTT, C. H B.
ELKINS, Councillor W. H.
FINN, ANTHONY, M A., LL.D.
GRANT, Miss JANET.
JACKSON, ROBERT.
JARMAN, Rev. G.
JOSE, W. W., J.P.
LOWE, ALDERMAN, C. J., J.P.
SHEPPARD, F.
SKERRITT, E. MARKHAM, M.D., F.R.C.P.
SMITH, R. SHINGLETON, M.D., F.R.C.P.
SYMES, J. ODREY, M.D., D.P.H., M.R.C.S.
TOWNSEND, Miss F. MARION.
WEIR, PRESTON, B.A.
WAIT, Miss MABEL S. K.

Secretaries.

WILLIAM AVERY ADAMS. | T. S. FOSTER, M.A.

Recording Secretary.

JAMES KERR, M.A., M.D., D.P.H., LONDON.

This Conference is open to all interested in the subject.

Order of Proceedings.

MONDAY, JULY 9TH.

12.30 p.m.—Reception of Members and Delegates in the Council House, by the Rt. Hon. the Lord Mayor (A. J. Smith, J.P.)

1.30 p.m.—Public Luncheon in Royal Hotel, limited to 300. (Tickets 3/6). The Rt. Hon. the Lord Mayor will preside.

3 p.m.—Opening of the Health Exhibition in the Drill Hall, Queen's Road, by the Rt. Hon. the Lord Mayor.

7 p.m. to 8 p.m.—Organ Recitals and Reception of the Members of the Congress in the Victoria Rooms, by the High Sheriff (H. L. Riseley) and Miss Riseley.

8 p.m.—Inaugural Address to the Congress, in the Victoria Rooms, by THE RIGHT HON. SIR EDWARD FRY, P.C., D.C.L., LL.D., F.R.S.

TUESDAY, JULY 10TH.

10 a.m.—Meeting of Section I. (Sanitary Science and Preventive Medicine); Conferences of Municipal Representatives, and Engineers and Surveyors to County and other Sanitary Authorities, in the Victoria Rooms, University College, and the Blind Asylum. *(See pages 102, 104, and 105.)*

3.30 p.m.—Visits to Local Places of Interest.

WEDNESDAY, JULY 11TH.

10 a.m.—Meetings of Section II. (Engineering and Architecture; Section I. (Sanitary Science & Preventive Medicine); Conferences on Hygiene of School Life and Sanitary Inspectors, in the University College, Victoria Rooms, and the Blind Asylum. *(See pages 102, 103, and 106.)*

3.30 p.m.—Garden Party in the Grounds of Goldney House, Clifton, by permission of the Rt. Hon. Lewis Fry, P.C.

8 p.m.—Lecture to the Congress, in the Victoria Rooms, "*The Relation of Heredity to Physical Degeneration,*" by PROF. LLOYD MORGAN, LL.D., F.R.S.

THURSDAY, JULY 12TH.

10 a.m.—Meetings of Section III. (Physics, Chemistry, and Biology); Section II. (Engineering and Architecture); Conferences of Medical Officers of Health and Women on Hygiene, in the Blind Asylum, University College, and Victoria Rooms. *(See pages 103, 104, and 106.)*

3 p.m.—Garden Parties and Visit of Inspection to King Edward Dock (in course of construction) at Avonmouth, and other Public Works.

8 p.m.—Conversazione, and Reception in the Art Gallery, by the Rt. Hon. the Lord Mayor.

FRIDAY, JULY 13TH.

10 a.m.—Meeting of Section III. (Physics, Chemistry, and Biology); Conference of Veterinary Inspectors, in the Blind Asylum and University College. *(See pages 103 and 105.)*

1.30 p.m.—Closing Meeting in the Victoria Rooms.

3 p.m. to 6 p.m.—Reception of Delegates and Members in the Health Exhibition, by THE CHAIRMAN AND COUNCIL OF THE INSTITUTE.

8.0 p.m.—Popular Lecture, by COUNCILLOR W. F. ANDERSON, J.P.

SATURDAY, JULY 14TH.

Excursions.

Excursions and Visits to places of interest will be made during the Congress.

[*Particulars will be given in future Programmes.*]

The following Set Subjects have been arranged for Discussion in :—

Section I.—SANITARY SCIENCE AND PREVENTIVE MEDICINE.

"An International System of the Notification of the more serious Infectious Diseases," to be introduced by E. WALFORD, M.D., D.P.H.

Section II.—ENGINEERING AND ARCHITECTURE.

"The Construction of Isolated Homes for the aged poor *versus* the Workhouse," to be introduced by A. SAXON SNELL, F.R.I.B.A.

Section III.—PHYSICS, CHEMISTRY, AND BIOLOGY.

"The Influence of Dust on Health," to be introduced by PHILIP BOOBBYER, M.D.

Conference of Municipal Representatives.

"The Rational Extension of Modern Cities," to be introduced by ARTHUR RICHARDSON, M.P.

Conference of Engineers and Surveyors.

"Rural Road Construction and Maintenance," to be introduced by R. PHILLIPS, M.INST.C.E.

Conference of Medical Officers of Health.

"Amendment of existing Laws and the need of Additional Powers for greater efficiency in Public Health Administration."

Conference of Veterinary Inspectors.

"Milk Contamination in Collection and Transit," to be introduced by J. S. LLOYD, F.R.C.V.S.

(Section I. will join in this Discussion.)

Conference of Sanitary Inspectors.

"Advantages of Public Abattoirs," to be introduced by GEO. ANDERSON.

Conference of Women on Hygiene.

"Suggestions for the Improvement of Infant Feeding," to be introduced by Miss EDITH EVANS.

Conference on the Hygiene of School Life.

"Instruction and Hygiene in Training Colleges," to be introduced by Miss ALICE RAVENHILL.

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Water Supply, Sewerage and Refuse Disposal.

CHICK, Dr. HARRIETTE. A Study of the Process of Nitrification with reference to the Purification of Sewage. *Proc. R. Soc.*, Ser. B., Vol. 77, 1906, pp. 241–246.

Statement of the objects of the research. Chemical Study of nitrification in experimental filters. Bacteriological investigations. Absorption of ammonia and ammoniacal compounds during sewage purification. General conclusions. Tables of the results of experiments.

WHITTAKER, W. Memoirs of the Geological Survey, 1906. The Water Supply of Suffolk from Underground Sources, with Records of Sinkings and Borings. Price 3s. 6d. Bk. VI., 177, Map (rainfall).

Gives general results on wells and borings in the county, particularising the notable ones. Notes the geologic formations, especially those which are water-bearing. Gives various statistics of areas. The rainfall is treated of by Dr. H. R. Mill. The bulk of the memoir consists of details of wells and borings for water. but trial-borings for other purposes are also described, and a great number of water-analyses are given. Dr. W. F. Parsons and Dr. J. C. Thresh have assisted with information of various kinds.

MEETINGS HELD.

EXAMINATIONS.

Sanitary Science as applied to Buildings and Public Works.

Hong Kong, April 18th & 20th; 3 Candidates; 3 Certificates granted.
Edinburgh, May 18th and 19th; 4 Candidates; 2 Certificates granted.
York, June 1st and 2nd: 1 Candidate; 1 Certificate granted.
Leeds, June 15th and 16th; 1 Candidate; no Certificate granted.

Inspectors of Nuisances.

Hong Kong, April 18th & 20th; 4 Candidates; 1 Certificate granted.
Edinburgh, May 18th & 19th; 26 Candidates; 14 Certificates granted.
Dublin, May 25th & 26th; 4 Candidates; 3 Certificates granted.
York, June 1st and 2nd; 19 Candidates; 10 Certificates granted.
Leeds, June 15th and 16th; 21 Candidates; 11 Certificates granted.

Hygiene in its Bearing on School Life.

Edinburgh, May 18th & 19th; 5 Candidates; 4 Certificates granted.
York, June 1st and 2nd; 1 Candidate; 1 Certificate granted.
Leeds, June 15th and 16th; 30 Candidates: 15 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Gidley, Hubert John William.
Goldsmith, Henry Edward.
O'Brien, Patrick Joseph.
Raven, Arthur Robert Fenton.
Robinson, Harold Victor.
Tweedie, Fred C.

Inspectors of Nuisances.

Ayton, Ernest Walter.
Bailey, Joseph.
Balchin, Walter Edmund.
Bedford, James Frederick.
Bilton, Frederick.
Clayton, Charles Percival Glanville.
Clement, Aleyander, Abercromby.
Davies, Thomas Edwin.
Easdale, Thomas George.
Fairbairn, Laura Marion.
Firth, Herbert Goodwin.
Furse, Bartholomew.
Gaitskell, John.
Garnett, Ernest.
Hamar, George Wolley.
Hayton, Louisa.
Hooper, Charles Rodney.
Jowett, Lilian.
Kilburn, Richard Hugh.
Kingston, Walter George Frederick.
Linsley, William.
Longstaff, Alfred.
Mackay, Elizabeth Lyon.
Macmillan, Jessie Cameron.
Miller, John.
Monteith, John.
Moralee, Lonsdale.
Mulgrew, Kathleen.
Mulgrew, Margaret.
O'Halloran, Daniel Joseph.
Quigley, John, Junr.
Richardson, Ernest.
Robertson, Thomas, Junr.
Taylor, Leonard.
Ryrie, George Alexander Ross.
Swanson, Archibald Hope.
Thomson, Margaret Jane.
Topham, Harriet Emma.
Whitehead, Frank.

Hygiene in its Bearing on School Life.

BRACEWELL, ROWENA MAUDE.
CHAPPELL, MARTHA ANN.
CLEGG, THOMAS.
CLIFFE, LOUISA.
CORY, LILIAN F. P.
FRY, MABEL LILIAN.
GREENWOOD, ANNIE.
HOLMES, ALICE.
KIDD, WILLIAM.
LONGBOTTOM, ABRAHAM.
MCKINNA, ALEXANDER.
PAWSON, HARRY.
RELF, FLORENCE EMILY.
RICHARDSON, ELIZABETH MARY.
ROBERTS, ETHEL ADAIR.
ROWBOTHAM, FELICIA.
SMAIL, ADAM.
SMITHSON, SARAH KERSHAW.
VULLIAMY, EDWARD O., B.A.CANTAB.
WOODRUFF, WILLIAM JAMES.

FORTHCOMING MEETINGS.

Bristol. CONGRESS, July 9th–14th, 1906.

A Preliminary Programme of the Congress was given at pages 90–108 of the last issue of the Journal, XXVII., No. 5.

CALENDAR, JULY, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

JULY.

9–14	**Congress, Bristol.**
9–21	**Exhibition** ,,
20 F. 21 S.	Examinations in Sanitary Science as applied to Buildings and Public Works, in Hygiene in its bearing on School Life, and for Inspectors of Nuisances, Cardiff.
27 F. 28 S.	Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Norwich.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

FELLOWS.

1938 1906. June. BRUNTON, Sir Lauder, LL.D., M.D., D.SC., F.R.C.P., F.R.S., 10, *Stratford Place, W.*

1927 1906. June. McVAIL, John C., M.D., M.B., C.M., D.P.H., F.R.S.E., (*M.O.H.*), 24, *George Square, Glasgow.*

1901 1906. June. MACFAYDEN, Allen, M.D., B.SC., F.I.C., 14, *Daleham Gardens, Hampstead, N.W.*

1813 1906. June. ROFE, Henry, M.INST.C.E., F.G.S., 8, *Victoria Street, S.W.*

1631 1906. June. STARKEY, T. A., D.P.H., M.B., M.R.C.S., L.R.C.P., *Prof. of Hygiene, McGill University, Montreal.*

1364 1906. June. STILGOE, Henry Edward, M.INST.C.E., *City Engineer, Birmingham.*

1829 1906. June. STRACHAN, George Richardson, M.INST.C.E., 9, *Victoria Street, Westminster, S.W.*

1836 1906. June. TANNER, Sir Henry, I.S.O., F.R.I.B.A., F.S.I., *H.M. Office of Works, S.W.*

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

2092 1906. June. ACTON, Edward Vincent, ASSOC.M.INST.C.E., *Engineer's Office, Town Hall, Port of Spain, Trinidad, B.W.I.*

2093 1906. June. EAYRS, Thomas William, *Thornlea, Beeches Road, West Bromwich.*

2094 1906. June. PARRY, Edward, *Surveyor, Long Crendon, Thame, Oxon.*

2095 1906. June. PETERS, Owen Herbert, M.B., CH.B., D.P.H., *Bagthorpe Hospital, Nottingham.*

2096 1906. June. SMALL, Leonard John, *Council Offices, Broadstairs.*

2097 1906. June. TULLEY, George William, *H.M. Office of Works*, 3, *Parliament Sq., Edinburgh.*

2098 1906. June. VAN PUTTEN, Ernest, M.INST.C.E., *Borough Engineer and Surveyor. Town Hall, Catford, S.E.*

2099 1906. June. *BARLASS, Thomas, 45, *College St., Belvedere Rd., S.E.*

2100 1906. June. *M*FITZWILLIAMS, Capt. Edward Crawford Lloyd, A.S.C., *Cilgwyn, Newcastle Emlyn R.S.O., Carmarthenshire.*

2101 1906. June. *GOLDS, Alfred, *R.E. Office, Bordon Camp, Hampshire.*

2102 1906. June. *Polkinghorne, George Henry, *Royal Engineers, Albany Barracks, Parkhurst, Isle of Wight.*

2103 1906. June. *Wainwright, Walter Hepburn, 13, *Oakley Street, Chelsea, S.W.*

2104 1906. June. *Ward, Thomas, assoc.m.inst.c.e., c/o *Mrs. Durrans, 1, Cornwall Terrace, Clarence Gate, Regent's Park, W.*

2105 1906. June. *West, Richard Alexander, 7, *Thurley Road, West Norwood, S.E.*

2106 1894. Jan. †‡Willis, Edward, *Tregarth, Prout Grove, Neasden, N.W.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life (Practical Hygiene for School Teachers).

3449 1906. June. Jones, John, *Town Hall, Spa Road, Bermondsey, S.E.*

3450 1906. June. ‡Ashwood, Herbert, *Woodland Grange, Hopwas, Tamworth, Staffs.*

3451 1906. June. ‡Brown, Albert Bentley, 34, *Pennington Road, Gt. Lever, Bolton, Lancs.*

3452 1906. June. *M*Clayton, W. E., *Royal Victoria Yard, Deptford, S.E.*

3453 1906. June. ‡Caesar, Francis George, *The Schools, Hale, Farnham.*

3454 1906. June. ‡Camble, Frederick, 4, *Castle Street, Exeter.*

3455 1906. June. ‡Cooper, Frederick Wade, "*Palmeira,*" *Hermon Hill, S. Woodford.*

3456 1906. June. ‡Corin, Herbert Richard, *Trewartha Terrace, Penzance.*

3457 1906. June. ‡Cross, C. G. M., *Surveyor's Assistant, Frome.*

3458 1906. June. ‡Davies, Miss Mary, 17, *Pine Street, Farringdon Rd., E.C.*

3459 1906. June. ‡Faulkner, Henry Robert, 8, *Thanet House, Upper Park Street, N.*

3460 1906. June. *S*Foulsham, Miss Jessie Gladys, 135, *Willesden Lane, Brondesbury, N.W.*

3461 1906. June. ‡Gardner, Thomas, 17a, *Oakmead Rd., Balham, S.W.*

3462 1906. June. ‡Hall, William Ewart, 2, *Clifford Street, Wolverhampton.*

3463 1906. June. ‡Holman, Frank Sinclair, 4, *Richmond Road, Ilford.*

3464 1906. June. ‡Hooper, C. Rodney, 79, *Ashley Terrace, Edinburgh.*

3465 1906. June. ‡Hughes, James Thomas, 1, *Dyke Street, Merthyr Tydfil.*

3466 1906. June. ‡Jacobs, Miss Julie Amélie, *The Old Vicarage, Ash, near Dover.*

3467 1906. June. ‡Jeffery, Edgar Thomas, 110a, *West Street, Maidstone.*

3468 1906. June. ‡Knowles, George, Junr., 28, *Kingsley Road, Maidstone.*

3869 1906. June. M‡Lloyd, Charles Burton Wilkinson, 316, *Fulham Palace Road, S.W.*
3870 1906. June. ‡Lowe, Miss Mary, 28, *York Road, Battersea.*
3871 1906. June. ‡Mackay, Miss Elizabeth Lyon, 125, *George St., Edinburgh.*
3872 1906. June. ‡McNair, William, 28, *Althorp Road, Wandsworth Common, S.W.*
3873 1906. June. ‡Martin, William, 104, *Waterloo Road, Burslem.*
3874 1906. June. ‡Monk, John Henry, 32, *Station Road, Poulton-le-Fylde, Lancs.*
3875 1906. June. ‡Monteith, John, *Ellon Cottage, Dalkeith, Edinburgh.*
3876 1906. June. ‡Perrin, John Manoah, 40, *Camden Terrace, Green Lanes, Essex.*
3877 1906. June. ‡Pitstow, George, 38, *James Street, Cambridge.*
3878 1906. June. ‡Rees, Alfred Edward, *Housing Dept.*, 23, *Cockspur Street, S.W.*
3879 1906. June. ‡Saint, Russell George, 24, *New Road, Ilford.*
3880 1906. June. ‡Small, Victor Andrew, 19, *Camden Passage, Islington, N.*
3881 1906. June. ‡Smith, James, 11, *South Primrose Street, Tyldesley, Manchester.*
3882 1906. June. ‡Taylor, Harry T., 20, *Trimworth Road, Folkestone.*
3883 1006. June. ‡Teasdale, Miss Bessie, "*Tormount,*" *Walpole Road, Brighton.*
3884 1906. June. ‡Thomas, Arthur, 9, *Woodfield Road, Ealing, W.*
3885 1906. June. ‡Thomson, Miss Margaret Jane, *Millfield, Strathmiglo, Fifeshire.*
3886 1906. June. §Turner, Miss Maria Elizabeth, 6, *Clifton Road, Crouch End, N.*
3887 1906. June. ‡Wallis, George W., 91, *London Road, Brighton.*
3888 1906. June. ‡West, John Thomas, 43, *Grosvenor St., Stepney, E.*
3889 1906. June. ‡Westbrook, Ernest Reece, *New Street, Oakengates, Salop.*
3890 1906. June. ‡Wilson, Miss Annie Robertson, 125, *Newmarket Road, Cambridge.*

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*** *For Publications of Societies and Institutions, etc., see under "Academies."*

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Coventry, 1905	*E. H. Snell, M.D., B.Sc., F.R.S.Edin.*
Edinburgh, 1905	*A. Maxwell Williamson, M.D., B.Sc.*
Huddersfield, 1st quarter, 1906	*S. G. Moore, M.D., D.P.H.*
Hunslet, 1905	*J. Buck, L.R.C.P.*
Gibraltar, 1905	*Major W. H. Horrocks, M.B., B.Sc., D.P.H.*
London, Port of, 1905	*H. Williams, M.D., D.P.H.*
Sandal, 1905	*J. R. Kaye, M.B., D.P.H.*
Scarborough, 1905	*J. Knight, M.D., D.P.H.*
Southend-on-Sea, 1905	*J. T. C. Nash, M.D., D.P.H.*
Surbiton, 1905	*O. Coleman, M.D., M.R.C.S.E., D.P.H.*

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GENERAL NOTE.

The Second International Congress on the Promotion of Hygiene and Salubrity of Dwellings, announced in the Supplement to the Journal, Vol. XXVII., No. 3, p. 36, to be held at Geneva, has been fixed for September 4th–10th.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	117	9	0

Contributions since last report.

Gilbert J. Fowler	1	1	0
Miss Eva H. Jones	1	1	0

June 30th, 1906.

NOTES ON THE CITY OF BRISTOL,

Where the Congress is to be held this year. By A. LANGLANDS.

BRISTOL, where the Congress meets this month, has risen and thriven entirely by trade, that is to say, it has owed nothing to nobleman or prelate.

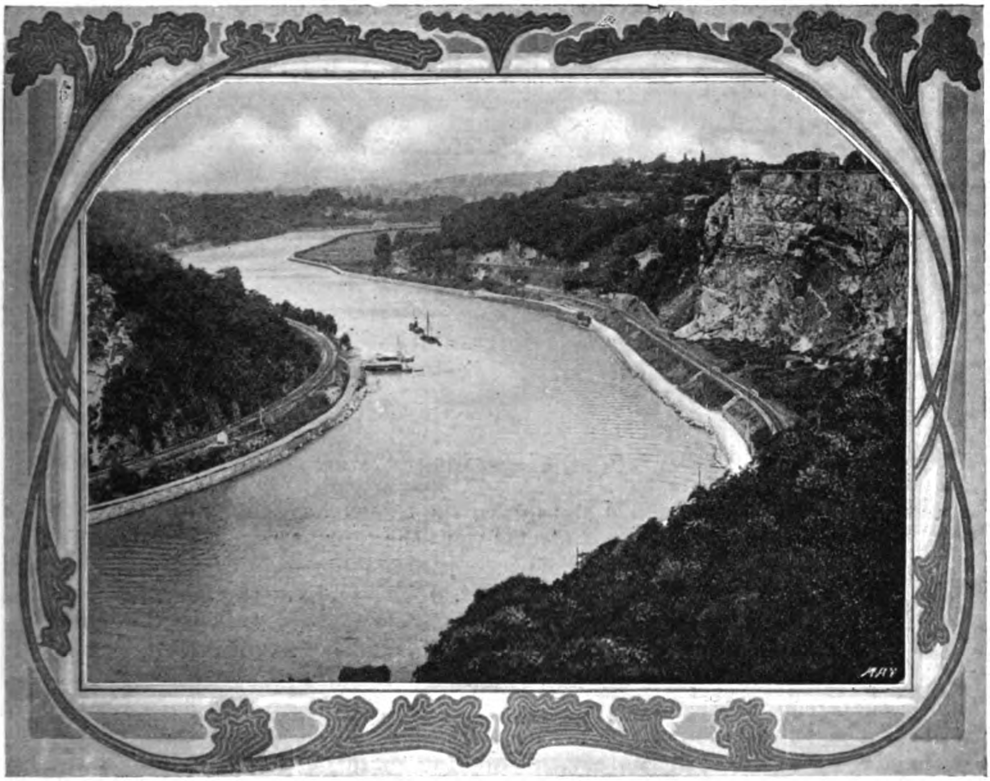
VICTORIA ROOMS, WHERE THE RECEPTION ROOM IS ARRANGED.

The first Bristol traffic of which we hear was that in slaves, who were shipped to Ireland in circumstances of great cruelty. This was put down by the preaching of St. Wulfstan, the Bishop of Worcester, about 1090. William of Malmesbury, writing about 1140, speaks of Bristol as the resort of ships coming from Ireland, Norway, and other countries beyond sea. The marriage of Henry II. with a princess of France was followed by a large importation of wines, and Bristol became a great centre of this trade. The charter of Prince John, granted abont 1188, regulated the dealings of strangers in leather, wool, corn, wine and cloth, probably for the protection of the chief trades of the town. About the same time Bristol is described as a place where everybody is, or has been, a soap maker. Soap making still flourishes, corn merchants abound, and Bristol is still one of the great seats of the leather trade. It is also a chief centre for the distribution of provisions.

Trades which have thriven for centuries confer a nobility on trading

men. The lives of William Canynge, Edward Colston, and Samuel Budgett have shed lustre alike upon their native city, and upon the commercial pursuits they were engaged in.

Her merchant princes in the past made Bristol famous, and it is probable



THE RIVER AVON FROM CLIFTON BRIDGE.

that to-day, Wills's tobacco and Fry's chocolate are known wherever the English language is spoken, and they are the products of Bristol enterprises.

But Bristol's crowning glory is yet to be. As a shipping port it has held a leading position, and it begins the twentieth century by constructing docks at the head of the Bristol Channel, of such magnitude and cost as to surpass all municipal achievements in this direction.

The shipping trade of the port with distant parts of the world dates back many centuries. Vessels were formerly discharged and loaded at landing stages along the banks of the tidal river Avon, which then flowed through the heart of the city. In 1809 a new course for the river was formed, and the old waterway for a length of two and a-half miles was

converted into a floating harbour. This is now equipped with modern wharves, granaries, transit sheds, cranes and railways. Many large manufactories and other industrial concerns are located in the immediate neighbourhood of the quays.

In the course of the last forty years the river navigation has been greatly improved. The channel has been deepened, the banks and points have been marked by a series of posts and lights, and a new entrance-lock has been constructed, the result being that it is now possible for vessels 320 feet in length to enter the city docks with little or no delay. The Avonmouth and Portishead docks are at the mouth of the river, and afford accommodation for ocean-going vessels of large dimensions.

Some historians find Bristol's commencement in the days of Æthelred the Unready. But the fact that in the year 980 money was coined in it, would point to its being at that time a place of some importance. The town originally stood upon a little peak of land on an islet formed by the two rivers, the Avon and the Frome. Above rose up hills and wooded heights forming a kind of protecting circle round the little cluster of houses, gates, walls, and churches. But before the houses came, there seems to have been a bridge.

At the present day there are four streets not more than a stone's throw from Bristol Bridge. They are called High Street, Broad Street, Wine Street, and Corn Street. They cross at right angles; at the place where they meet the old High Cross once stood. Round it, for ten centuries at least, has ebbed and flowed the tide of busy human life.

At the ends of these four streets were the four gates. Even now the circle of the boundaries can be paced through narrow curved lanes that follow the course of the old walls. St. John's Gate at the foot of Broad Street still remains.

Of Bristol Castle, which was exceeded in massive strength only by the Tower of London, there are now few visible remains: but Castle Street, Castle Green, Castle Ditch, and Tower Street mark the site. In Castle Green is still standing one of the arched entrances to the royal apartments. In the 12th century, during the reign of Stephen, the Castle played a great part as a stronghold; and it survived until the successful storming of Bristol by the army under Fairfax and Cromwell.

The Cathedral was formerly the Abbey Church of the Monastery of St. Augustine, founded in 1142. Portions of the original buildings remain. The Norman work in the chapter house is exceedingly fine. The abbey gateway or arch, leading from Upper to Lower College Green, is a beautiful specimen. The Norman nave of the abbey church was demolished in the 15th century with a view to re-erection. But meanwhile came on the Reformation. In 1542, on the dissolution of the monasteries and the subsequent formation of the See of Bristol, the church was converted into a cathedral, and the dilapidations were partly repaired. After an interval of over three hundred years, liberal-spirited churchmen resolved on carrying out the designs of Abbot Knowle. The nave with the two western towers have been completed from plans by the late G. E. Street.

THE CATHEDRAL.

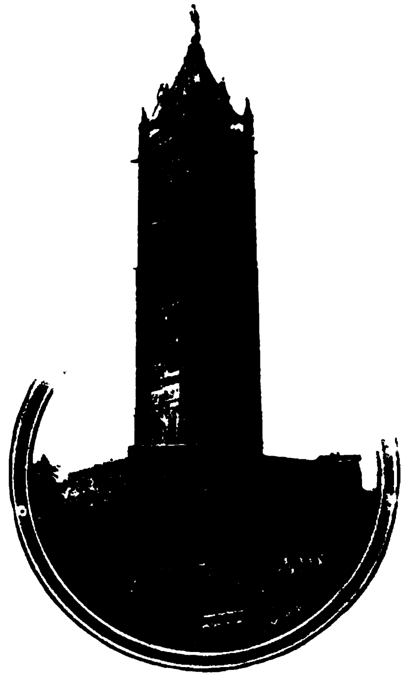
The chief points of interest in the Cathedral are the Chapter House, with its vestibule, the vaulted ceiling, the window over the altar, one of the largest and finest decorated windows in the kingdom, the Elder Lady Chapel with its bold sculpture and its Early English capitals, the curious wood carvings under the miserere seats, and the ancient Berkeley monuments.

The Bishop's Palace is on Redland Green. Its chapel is unique among private chapels, and is singularly effective. There are portraits of former bishops in the palace, including one of Bishop Trelawney, who was one of the seven bishops sent to the Tower by James II.

Queen Elizabeth termed St. Mary Redcliff Church "the fairest, the goodliest and most famous parish church in England," and a modern authority says, "As compared with the cathedral and conventual churches of England, it surpasses most in symmetry of design, in harmony and unity of character." Popular tradition ascribes this magnificent erection to Simon de Burton about 1300. Hogarth painted three altar-pieces for this church. In the nave is a monument to Admiral Sir William Penn, father of the founder of Pennsylvania. Above the north porch is the famous muniment room where Chatterton found, so he said, the poems of Rowley.

A quaint relic of the former glories of Bristol domestic architecture is to be seen in what is now called St. Peter's Hospital. Built in the fourteenth century by John Norton, the most skilful alchemist of his age, and afterwards the abode of several notable people, it is now used as the meeting place for the Bristol Board of Guardians, the oldest board of guardians in England.

The Cabot Tower, ten minutes' walk from the centre of the city, is a memorial to the discoverers of Newfoundland. It is in an appropriate position, can be seen from all directions, and overlooks the upper reaches of the port, from which John Cabot and his son Sebastian, citizens of Bristol, sailed on their voyage of discovery in May, 1497.



THE CABOT TOWER.

In the long struggle for civil and religious liberty Bristol has played a prominent part. In the Baptist College at Stokes Croft is a unique copy of Tyndale's first New Testament, 1526. In Broadmead Chapel the Baptists have worshipped since 1671, not always in peace. And not far off is the first Methodist chapel that was built in England, where John Wesley preached. In the evil days of Mary there were Free Church martyrs who breathed their parting prayer upon the ground where Highbury Chapel now stands.

At Müller's Orphanages a great work of love has been carried on for over sixty years. In that time over a million and a half sterling has been received. Yet there has been no organised staff of collectors; no published list of annual subscribers' names; not a single personal application; but debt was never incurred. There is no invested fund for future need.

The history of Bristol is not lacking in the names of some who are known in literature and the arts. Robert Southey, poet-laureate from 1813 to 1843, was the son of a Bristol linen-draper. And it is to the enterprise of a Bristol publisher, Joseph Cottle, whose premises were at the corner of High Street and Corn Street, that the British public are indebted for the earliest issue of the works of Samuel Taylor Coleridge and William Wordsworth. How can one linger over the story of that other genius, Thomas Chatterton? The comedy of his literary impostures, the pitiful vaulting of his ambition, the tragedy of his untimely

end, are too widely known to need comment. Hannah More was born in Stapleton Road, and kept a boarding-school at a house in Park Street which still bears her name. Miss Mills, Lord Macaulay's mother, succeeded her in the management of the school. It was on the quays of Bristol that Defoe met Alexander Selkirk, just returned from Juan Fernandez, and got the ideas reproduced in "Robinson Crusoe." Among Bristol's sons are also Sir Thomes Lawrence, a President of the Royal Academy, who was born in Redcross Street; Henry Hallam, the son of a Dean of Bristol, received his education at the Grammar School. Sir Humphrey Davy began his work at Hotwells, and Edmund Burke, "the greatest philosopher in practice the world ever saw," was for six years member of Parliament for Bristol.

Mrs. Emma Marshall has written many books setting forth in romantic form the historical aspects of life in Bristol.

NEW ART GALLERY.

On the right hand side is the entrance to the Building used for the Health Exhibition in connection with the Congress.

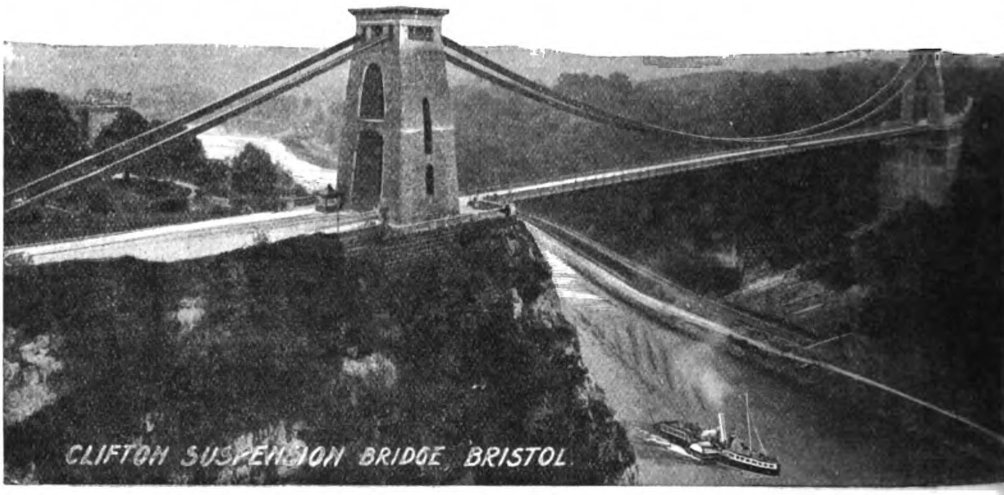
The new picture-gallery, the gift of the head of the Wills family, the new Central Library, and the University College are evidence of recent advance in art, literature, and science.

It may be difficult for a stranger to form a clear conception of the site of the little settlement of Anglo-Saxons on the peak of land between the two rivers, which ultimately developed into the second seaport of the

kingdom, and has now expanded into the spacious and wealthy city of the present day.

Old Bristol outrivalled many other ancient towns in the narrowness of its thoroughfares. Down to a century ago even the leading streets, near the council house, were in some places only fifteen feet in width. In not a few the dwellers in opposite houses could touch hands at the upper windows. The extensive street improvements effected within living memory have led to the destruction of a large number of picturesque ancient dwellings—to the grief of many lovers of the past, but to the relief of the population at large.

The general movement has been, like the course of civilization in Europe, towards the West. When Henry VII. paid a visit to Bristol he was not satisfied with demanding a "benevolence" of £500. He levied a fine of 20s. each on all the townsmen worth £20, because in his majesty's opinion their wives went about "too sumptuously apparelled!" King Edward VII. would visit Clifton, if he were in search of similar exactions.


CLIFTON SUSPENSION BRIDGE, BRISTOL.

The open breezy Clifton Downs are beautiful in every season with hawthorn trees and gorse, arching avenues of chestnuts, with glimpses between of graceful birches or spreading scented limes, with cliffs and rocks and winding river. From the heights one sees the wide-spreading glittering channel, breathes new life and feels the health-giving atmosphere of the place. The British-Roman camp on Observatory Hill is still full of interest. From its embankments one looks down upon the old Roman ford to the other camps, which can still be traced in Leigh Woods across the river: a turn to the left and the modern passage by the famous Suspension Bridge is seen. Beyond lie the open country, wide sweeping vales and rich woodland—a view the beauty of which can hardly be surpassed in the suburbs of any great city of the world.

THE ROYAL SANITARY INSTITUTE.

REVIEW.

TESTS OF CERTAIN OPEN DOMESTIC GRATES MADE BY THE COAL SMOKE ABATEMENT SOCIETY, DECEMBER, 1905.

The two series of tests which had in former years been carried out by the Coal Smoke Abatement Society, the details of which were published in the *Lancet* of May 10th, 1902 (p. 1342), and Feb. 20th, 1904 (p. 529), respectively, created much interest both in the trades concerned and amongst the public, and the Society, in the Autumn of 1905, arranged to carry out further tests on a more extensive scale. Sir Henry Tanner, chief architect to H.M. Government, having given facilities for the tests in the large block of buildings situated at the corner of Great George Street and Parliament Street, Westminster, in course of construction under his superintendence, a Sub-Committee of the Society, consisting of Dr. H. A. Des Vœux and Mr. W. H. Atkin Berry, F.R.I.B.A., the latter nominated as a member of the Society by the Royal Institute of British Architects, was appointed to act in conjunction with Sir Henry Tanner in conducting the tests.

The tests were conducted during the four days, Dec. 4th, 5th, 6th, and 7th, 1905.

Mr. H. C. Burnand was chosen to superintend the staff, and his duties were those of general supervisor, viz., to see that the fires were properly lighted and stoked, the temperatures correctly recorded, and the smoke charts properly filled in. Under him were eight assistants. Three attended to the weighing of the coal and wood, stoking the fires, and also recording the temperatures; and five were appointed to register the smoke. Of these, four were stationed on the roof in separate shelters, each shelter being in clear view of the six chimneys which were allotted to each observer. The fifth assistant acted as relief.

The grates were indicated only by distinctive numbers, and the chimneys by distinctive letters of the alphabet painted on each flue pot. The names of the grates were unknown to the testers. The allotment of chimneys for observation by each of the smoke recorders was changed on each of the four days—the observers thus having a different set of chimneys every day. The fires were prepared first with a layer of chips, then of wood, and then of coal. The coal was weighed out and brought in carefully constructed trays, with two divisions, each division holding five pounds of coal. The fires were prepared each morning before 8 o'clock, at which hour they were lighted and were regulated throughout the day with the object of attaining and maintaining a temperature of 60° F. in the room or as near that as possible. The temperatures were recorded every half hour, one thermometer (No. 1) being placed in the corridor outside the rooms, and two in each of the rooms. Of the latter, one (No. 2) was fixed at a distance of five feet in front of the fire and three feet above the floor, and the other (No. 3) on the wall approximately 15 feet from the fire. The smoke emitted was registered according to the scale devised by the late Bryan Donkin (see *Lancet*, Feb. 20th, 1904), and was carefully recorded on charts at regular intervals of five minutes throughout the hours of testing, a separate chart being used for each flue. At 4 p.m.—*i.e.*, after eight hours—the fires were drawn,

and when cold the cinders were separated from the ashes and weighed, and the weight of cinders of each grate was recorded and was subtracted from the weight of coal placed on the fire. The wood supplied to each fire was also weighed, and half its weight was added to the amount of coal, making a grand total of the fuel actually burned.

Twenty-four grates were tested in the first instance, and upon the result obtained the examiners selected the following grates for further test, viz., those of Messrs. Candy, Messrs. J. & R. Corker, and the London Warming and Ventilating Co. (A). The amount of coal consumed by these grates was found to be moderate in comparative proportion with temperature obtained; the fires were bright and clear, and the smoke emitted bore favourable comparison with the results recorded for the other grates.

Arrangements were now made for testing the remaining twelve of the total number of grates selected from those submitted. They were fixed in twelve of the rooms used for the first set, and the tests were conducted in a precisely similar manner.

The tests were carried out on Jan. 2nd, 3rd, 4th, and 5th, 1906.

Upon the results obtained the examiners selected three grates to be tested again; inasmuch, however, as the grate submitted by the London Warming and Ventilating Company and that sent by Messrs. Smith & Wellstood were found to be identical, the latter was not subjected to this test.

The tests were carried out on Jan. 30th and 31st, and Feb. 1st and 5th. The results are set out in the following Table.

Table showing Results obtained in Re-testing Five Selected Grates.

Names of Firms (given in alphabetical order).	Amount of coal, less cinders, plus half wood, in pounds	Ashes in pounds.	Average stokings per day.	Temperature (degrees Fahrenheit).				Smoke.
				I. Thermometer in passage.	II. Thermometer in room.	Difference between I. and II.	Radiation.	
Candy & Co.	25·25	2·6	4·0	43·9	51·7	7·8	84·3	0·85
Corker, J. & R., Ltd.	26·0	1·3	4·0	,,	52·75	8·8	90·3	0·70
Hendry & Pattisson (Boyd)	35·9	2·25	5·75	,,	55·4	11·5	98·1	0·88
London Warming & Ventilating Co.	25·75	1·9	4·2	,,	50·6	6·7	82·2	0·79
Teale Fireplace Co.	26·25	1·3	4·0	,,	52·6	8·7	83·9	0·84

The amount of carbon-dioxide in the flue-gases was measured in the case of the grates in the final series of tests, and this enabled the efficiency of each grate as a warming apparatus to be determined.

Report upon the Thermal Efficiency of Five Domestic Fire-grates Tested on Feb. 5th, 1906, at the request of DR. DES VŒUX.

The following were the grates tested, which will be referred to by their respective letters:—

A.—Teale Fireplace Company .. .. .. Room 11B.
B.—Corker, J. & R., Ltd. .. .. ,, 12A.
C.—D. O. Boyd's Improved "Hygiastic" Grate, by Hendry & Pattisson .. .. ,, 12B.
D.—Candy & Co. .. .. ,, 13B.
E.—London Warming and Ventilating Co. .. ,, 14C.

The accompanying Abstract of Table exhibits the results of these tests, which were continued for a period of eight hours simultaneously on each grate.

Abstract of Table showing Results obtained in Testing Thermal Efficiency of Five Open Grates.

	A	B	C	D	E
Coal burnt in pounds per hour during test	$2\frac{1}{2}$	$3\frac{1}{8}$	$3\frac{3}{4}$	$3\frac{1}{8}$	$3\frac{1}{8}$
Cubic feet of flue gases passed per hour up chimney	6883	7934	9738	10,987	6320
Mean steady temperature of room	54° F.	56° F.	59° F.	54° F.	51° F.
Mean rise of temperature of air passed through room from inlet temperature	14° F.	16° F.	20° F.	14° F.	11° F.
Contents of room in cubic feet	3871	3974	3926	3931	4216

As a final result of the whole of the tests before described, the examiners find that of the grates submitted those of Messrs. J. & R. Corker, Messrs. Candy & Co., and Messrs. Hendry & Pattisson (Boyd's) are the best, showing practically equal results, and that the "Florence" (the London Warming and Ventilating Company) very nearly approximates to them.

It must be remembered that all these grates were worked with the object of obtaining their utmost capacity, and not under the conditions obtaining in an ordinary room which would generally be more variable. The fires were not allowed to burn low, therefore the amount of smoke emitted in these tests was the minimum that can be expected.

Some of the grates tested were exhibited at the Exhibition of Smoke Abatement Appliances held by The Royal Sanitary Institute in December, 1905, and awards of Bronze Medals have been made to—

Bratt, Colbran & Co., Ltd.
Heaped Fire.

Coalbrookdale Co.
The Bostel Fire.

London Warming & Ventilating Co., Ltd.
"Florence" Grate.

MEETINGS HELD.

Sessional Meetings.

Derby, June 29th and 30th. The meeting was held in the Council Chamber on June 29th, when a discussion was opened by S. Barwise, M.D., B.Sc., County Medical Officer of Health, Derbyshire, and John White, F.I.C. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C. On Saturday, June 30th, visits were made to Messrs. Nestlé's Works at Tutbury, and to the Derby Sewerage Works.

CONGRESS AND EXHIBITION AT BRISTOL.

The Twenty-third Congress and Exhibition of the Institute was held at Bristol from July 9th to 14th, 1906.

Very suitable accommodation was provided for the meetings in the Victoria Rooms, University College, the Blind Asylum, and the Museum Lecture Theatre; and excellent arrangements were made for the reception and convenience of members.

The Exhibition was held in the Rifle Drill Hall, Queen's Road.

The Congress was received by the Rt. Hon. The Lord Mayor (A. J. Smith, J.P.), who formally opened the Exhibition.

The First General Meeting was held on July 9th. The Rt. Hon. Sir Edward Fry, P.C., D.C.L., LL.D., F.R.S., was installed as President of the Congress by Col. J. Lane Notter, Chairman of Council, and delivered his Inaugural Address.

The business of the Congress was divided into three Sections and seven special Conferences; particulars of these are given in the Programme of the Congress in the Supplement to No. 5 of the Journal.

During the Congress 86 Addresses, Lectures, and Papers were read in 18 meetings. The President's Address, Lecture to the Congress, and the Popular Lecture are published in the current Journal.

The papers read in the Sectional meetings, with the discussions upon them, will be published in subsequent numbers of the Journal.

During the meeting Excursions were made to Cheddar, Wells, Blagdon, Wye Valley, Chepstow Castle, Tintern Abbey, Caerment, Bath, Bradford-on-Avon, Weston-super-Mare, Minehead, Lynton, and Ilfracombe.

The members were most hospitably entertained at Garden Parties by The Rt. Hon. Sir Edward Fry, Mr. and Mrs. P. Napier Miles, Rev. A. A. David, and the Local Committee; and at the Excursions by Messrs. J. S. Fry & Sons, the Gloucester and North Hants Working Dairy, the Committees of the Bristol Corporation, and others.

Visits were also made to King Edward Dock, Avonmouth, and other municipal undertakings of the Corporation.

The numbers attending the Congress were as follows: Delegates, 422: Members and Associates of the Institute, 260; Associates of the Congress and other Subscribers, 106; Complimentary and Press, 130; making a total of 918.

Delegates were appointed by 200 Authorities and learned Institutions.

The Closing Meeting.

The Closing Meeting of the Congress was held on Friday, July 13th. W. Whitaker, B.A., F.R.S., presided.

Reports of the Work done in the different Sections and Conferences, and the Resolutions passed, were read by the respective Secretaries, and the Resolutions were referred to the Council of the Institute for consideration.

Proposed by William Whitaker, B.A., F.R.S., from the chair; seconded by Councillor Colston Wintle, M.R.C.S. (Chairman of the Local Committee):—

Resolved.—"That the most cordial thanks of The Royal Sanitary Institute and the Congress are due to the Right Hon. the Lord Mayor, the Lady Mayoress, the High Sheriff and Miss Riseley, and the Corporation of the City of Bristol, for the reception accorded to the meeting and for the welcome they have given to the Members in the City."

Proposed by T. J. Moss-Flower, Assoc.M.Inst.C.E., F.G.S., Hon. Local Secretary; seconded by Philip Boobbyer, M.D. (Nottingham):—

Resolved.—"That the sincere thanks of the Congress be tendered to the Principal and Council of University College, the Chairman and Members of the Museum Committee of the Corporation, the Committee of the Blind Asylum,

and the Colonel and Officers of the 1st V.B. Gloucestershire Regiment, for the very suitable and convenient rooms, and the facilities afforded to the Congress, which have greatly enhanced the success of the meeting."

Proposed by J. R. Kaye, M.B. (West Riding C.C); seconded by Alderman J. F. Coe (Halifax):—

RESOLVED.—"That the hearty thanks of the members of the Congress be given to those who have so kindly shown hospitality at private receptions, and given assistance at the various excursions, and granted privileges to the members attending the Congress, which have added so greatly to the pleasure and enjoyment of the meeting."

Proposed by E. G. Mawbey, M.Inst.C.E. (Leicester); seconded by Alderman Harkus (Newcastle-upon-Tyne):—

RESOLVED.—"That the earnest thanks of The Royal Sanitary Institute and of the Congress are due to Councillor Colston Wintle and the Local General Committee, to the various sub-Committees, and to the Honorary Local Secretary, Mr. Moss-Flower, for their arduous labours in their several departments, and for their unremitting exertions in carrying out the many details in the organisation of the Congress, which have culminated in such an eminently successful meeting."

Proposed by Samuel Rideal, D.Sc., F.I.C. (London); seconded by Mr. Maynard Froud (Bristol):—

RESOLVED.—"That the thanks of this meeting are due to the members of the Press for the full and accurate reports whieh have been published of the proceedings, and which are largely instrumental in the dissemination of the teachings of the Congress."

Proposed by William Whitaker, B.A., F.R.S., from the chair; seconded by Senhor J. M. Tedeschi (Portugal):—

RESOLVED.—That this meeting desires to express to the Right Honourable Sir Edward Fry, President of the Congress, their high appreciation of the great services he has rendered in presiding over the meeting, and their sincere thanks for the personal interest which he has so kindly displayed in its work, and for the courtesy and hospitality extended to the members attending."

AWARDS MADE AT THE EXHIBITION.

SILVER MEDAL.

WM. M. GLOVER & SONS, LTD.
Covered Dust Van (new pattern).
WM. M. GLOVER & SONS, LTD.
Warwick Sprinkler and Flusher.
HORSFALL DESTRUCTOR CO., LTD.
Refuse Destructor with Centrifugal Dust Catcher.
POCOCK BROS.
Padded Room Fittings.
ROBINSON & SONS, LTD.
Compressed Sanitary Towels and Surgical Dressings.

BRONZE MEDAL.

B. Maggs & Co.
Cleansed Flock.
Safety Water Elevator Co.
Safety Water Elevator Well Gear.
Wilson & Stockall.
Motor Ambulance.
Bristol Wagon & Carriage Works Co., Ltd.
Tipping Dust Van.
Nevile Engineering Co., Ltd.
Caink's Jets and Sprinklers for Watering Van.
Constable & Son.
House Refuse Tip Van.
"England" Works.
Steel Portable Cloak Room Fittings.
Ferris & Co., Ltd.
Aseptic Glass Serum Syringe.
John Knight & Sons.
Metal Inspection Covers with Non-Detachable Fastenings.
John Knight & Sons.
Gully Trap, Glass-lined, with Sealed Top.
John Knight & Sons.
Access Caps, Concentric with interior of pipes.
Wm. Harriman & Co., Ltd.
Channel Bends for Manholes.
Wm. Harriman & Co., Ltd.
Glazed Fireclay Ware Twin-Sink, with Central Overflow.
John Jones.
Cast-Iron Inspection Chamber, with Low-Level Cover.
John Jones.
Cast-Iron Intercepting Bottom for building into brick chamber.
Geo. Howson & Sons, Ltd.
Mural Bracket Closet; Angle Urinal.
Doulton & Co., Ltd.
Non-Concussive Water Mixing Valve.
Doulton & Co., Ltd.
Oval Operating Lavatory with Knee Operated Mixing Valve.
Doulton & Co., Ltd.
Glazed Fireclay Fireplaces.
Doulton & Co., Ltd.
School Urinal, with Vertical Water Check and Flush Riser to Channel.
Freeman Hines, Ltd.
Locking Bricks.
W. & R. Leggott, Ltd.
General excellence of Door and Window Furniture.
British Challenge Glazing Co., Ltd.
British Challenge Glazing Bars.
Spring Bending Co.
Spiral Wire Drain and Pipe Cleaner.
Candy & Co., Ltd.
Glazed Fireclay Fireplaces.
C. W. Outram & Co., Ltd.
Hassall W.C. Suite, with one and a half gallons flush.

J. S. Fry & Sons, Ltd.
Malted Cocoa.
J. S. Fry & Sons, Ltd.
Milk Chocalate.
Alfred Williams.
Canvas Outdoor Sleeping Chamber.
Pountney & Co., Ltd.
Non-Crazing Semi-Porcelain Ware.
J. Duckett & Son, Ltd.
Radial-jointed Trap Outlet.
T. Collins & Co.
Steam Oven for Bakeries.
Shanks & Co., Ltd.
Bath with Concave Plinth.
Shanks & Co., Ltd.
Adjustable Vulcanite Grill for Bed-Pan Suite.
Rowe Bros. & Co., Ltd.
Lead Pipes.
E. J. Arnold & Sons, Ltd.
Food Value Diagrams.
Monat & Co., Ltd.
Jacobs' Safety Mail Cart.
Combination Collapsible Ventilator Co.
Hopper Ventilator, with folding sides.
J. D. Prior.
Combined Grate and Heating Apparatus.
J. D. Prior.
Venetian Fire Grate with Pivoted Bars.
Iron & Marble Co,
Drawell Register Grate.
David Smith.
Combined Expansion Drain-Testing Plugs.
W. R. Baker.
Combined Coin Receiving and Registering Lock for Closets.

DEFERRED FOR FURTHER CONSIDERATION:

Edward Bennis & Co., Ltd.
Improved Smokeless Chain Stoker.
H. Birch, Killon & Co.
Fiddian's Distributor.
British Fuel Economiser and Smoke Preventer Co.
Bunsen Bridge for Boiler Furnaces.
F. C. Calvert & Co.
Carbolic Acid and other Disinfectants.
Doulton & Co., Ltd.
Anti-Scalding Control Apparatus for Bath.
Ferris & Co., Ltd.
Disinfectants.
George Howson & Sons, Ltd.
Automatic Drop-by-Drop Flushing Cistern.
George Howson & Sons, Ltd.
Asylum Safety Bath with Regulating Valves.
Jeyes' Sanitary Compounds Co., Ltd.
Disinfectants.

KILLGERM CO., LTD.
Disinfectants.
MAUGHAN'S PATENT GEYSER CO., LTD.
Geyser with Safety Gas Valve.
MCDOUGALL BROS.
Disinfectants.
G. PERCIVAL MILNES.
Automatic Apparatus for governing the Supply and Discharge in connection with Contact Filter-Beds.
G. PERCIVAL MILNES.
Automatic Apparatus for Dosing Sprinklers.
G. PERCIVAL MILNES.
Automatic Flushing Apparatus to discharge at varying intervals.
NEWTON, CHAMBERS & CO., LTD.
Disinfectants.
OZONAIR, LTD.
Ozone Machine.
PLASTOMENT ASBESTOS FLOORING CO.
Plastoment Asbestos Flooring.
SNOWDON, SONS & CO., LTD.
Disinfectants.

EXAMINATIONS.

Sanitary Science as applied to Buildings and Public Works.

Manchester, June 22nd and 23rd; 3 Candidates; 1 Certificate granted.
Cardiff, July 20th and 21st; 7 Candidates; 2 Certificates granted.

Inspectors of Nuisances.

Manchester, June 22nd & 23rd: 60 Candidates; 25 Certificates granted.
Cardiff, July 20th and 21st; 61 Candidates; 36 Certificates granted.

Inspectors of Meat and Other Foods.

Liverpool, June 29th & 30th; 8 Candidates; 4 Certificates granted.

Hygiene in its Bearing on School Life.

Manchester, June 22nd & 23rd; 4 Candidates; 1 Certificate granted.
Cardiff, July 20th and 21st; 1 Candidate; 1 Certificate granted.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES.

Sanitary Science as applied to Buildings and Public Works.

CHANT, FREDERICK CHARLES.
LINDON, RICHARD.
TAYLOR, JOHN.

Inspectors of Nuisances.

ALLEN, ANNIE HENRIETTA.
ASHWORTH, ARTHUR.
BARNISH, JOHN.
BARNES, CHARLES BEECH.
BARNES, FRED.
BAXTER, HERBERT WOOD.
BEDFORD, SARAH MARY.
BOLTON, HORACE WILFORD.
BROWN, JAMES.
CHAMPION, CHARLES.

Chrystall, Alex. William.
Clark, Robert John.
Clark, Thirza.
Cleator, Thomas Nicholson.
Collier, Annie Louise.
Darke, George Joseph.
Digwood, Percival John.
Dolphin, George.
Edwards, Albert Edwin.
Endacott, Albert George.
Ennor, William Henry.
Escott, Arthur.
Evans, Evan.
Fanner, Frank Alfred.
Hawkins, Edward Thomas Henry.
Hogarth, John James.
Horspool, Florence Isabella Hall
Howarth, Lawrence.
Howells, James Ivor.
Hunter, Thomas George Harry.
Hynam, Frederick.
Jacques, William Henry.
James, Evan William.
Jones, David.
Jones, David Eliezer.
Major, Richard.
Maxwell, Jane Carus.
McNeil, Sidney.
Milns, William.
Moore, Frederick William.
Morgan, Llewellyn.
Morgan, Morgan.
Morris, Percy Albert.
Ormesher, Albert Henry.
Owen, Robert John.
Page, Henry.
Pindar, Edward Bloye.
Pollard, Frank George.
Roberts, Edgar David.
Ryan, Thomas.
Southwick, William Drust.
Thorpe, Alexander.
Tilston, Joseph Herbert.
Wade, Florence.
Walton, Reuben Younger.
Washington, Wm. Arthur Irving.
Whitley, Richard George.
Williams, Idwal.
Williams, Isaiah.
Williams, John Picton.
Williams, Morgan.

Inspectors of Meat and Other Foods.

Adams, Albert Edward.
Dodd, James.
Smith, Thomas Henry.
Stevens, Wilfred John.

Hygiene in its Bearing on School Life.

Evans, Alexandra Eleanor.
Williams, Daniel Thomas.

FORTHCOMING MEETINGS.

Sessional Meeting.

Brighton, October 27th.—Discussion on "Co-ordination of Measures against Tuberculosis," to be opened by Sir Wm. Broadbent, Bart.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances under the Public Health Act, 1875—
Belfast, October 5th and 6th.
Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

Inspectors of Meat and other Foods—
Newcastle, October 26th and 27th.

In Hygiene in its bearing on School Life—
Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

Lectures to Sanitary Officers.

The Forty-second Course of Lectures and Demonstrations to Sanitary Officers will commence on Monday, September 10th. The Lectures are

arranged to include the subjects scheduled for the examination for Inspector of Nuisances held by The Royal Sanitary Institute and the Sanitary Inspectors' Examination Board (formed by The Sanitary Institute and other bodies).

Lectures on Sanitary Science as applied to Buildings and Public Works.

A Course of Lectures has been arranged to assist those desiring instruction in Sanitary Science as applied to Buildings and Public Works, suitable to Foremen of Works, Builders, and those engaged in Allied Trades, Managers of Property, Teachers and Lecturers, and others who are desirous of obtaining the Certificate of the Institute in Sanitary Science as applied to Buildings and Public Works.

Inspections and Demonstrations are arranged, and include visits to Disinfecting Stations, Municipal Depots, Artizans' Dwellings, Waterworks, Sanitary Works in Progress, Refuse and Sewage Disposal Works, etc., etc., and other Public and Private Works illustrative of Sanitary Practice and Administration.

The Course will commence on September 28th.

Course of Lectures on Hygiene in its bearing on School Life.

This Course of Lectures has been arranged to assist Teachers and others interested in the training of children and the structural conditions of the school, who purpose entering for the Examination of the Institute in Hygiene in its bearing on School Life.

The Second Course will commence on September 17th.

Course of Practical Training for Meat Inspectors

for candidates preparing for the Examination for Inspectors of Meat and Other Foods, conducted by The Royal Sanitary Institute.

The Seventh Course will commence on September 21st, and will consist of systematic Practical Training in the Inspection of Meat at a Cattle Market, including Demonstration on live cattle and sheep, slaughtering and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangements of markets and byres, etc.

Demonstration will also be arranged at a knacker's yard, where instruction regarding the flesh and organs of the horse will be given.

The Course will continue for two months.

Demonstrations will be given at the Institute on Friday evenings and at a Market on Saturday afternoons.

In addition to the Practical Training at a Market, the Course will include the Lectures on Meat and Food Inspection given in the Parkes Museum.

Special Course on Food and Meat Imspection.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Students preparing for the Examination for Inspectors of Meat and other Foods, conducted by The Royal Sanitary Institute, will commence on November 12th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

Calendar, August and September, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

6 M. **August Bank Holiday.**

SEPTEMBER.

10 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

12 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

14 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

15 S. Inspection and Demonstration of Wimbledon Sewage Works, at about 2.45 p.m. Conducted by C. H. Cooper, M.INST.C.E., Borough Engineer and Surveyor.

17 M. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

17 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by G. Newman, M.D., D.P.H., F.R.S.E., M.O.H., Finsbury.

19 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

19 W. Demonstrations in the Parkes Museum, at 6 p.m., Building Materials and Construction, by the Director, E. White Wallis, F.S.S.

19 W. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

19 W. Lecture to Sanitary Officers at 7 p.m, Duties of a Sanitary Inspector—General B: Indoor, by G. Newman, M.D., D.P.H., F.R.S.E.

21 F. Lecture. Meat Inspectors' Course at 6.30 p.m.

21 F. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

21 F. Demonstrations in the Parkes Museum, at 6 p.m., Baths and Lavatories, by the Director, E. White Wallis, F.S.S.

21 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by G. Newman, M.D., D.P.H.

22 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at about 2.30 p.m.

24 M. Demonstrations in the Parkes Museum, at 6 p.m., Waste Preventers and Water Closets, by the Director, E. White Wallis, F.S.S.

24 M. Lecture to Sanitary Officers at 7 p.m. Infectious Diseases, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H. Lewisham,

26 W. Lecture to Sanitary Officers at 7 p.m. Methods of Disinfection, by A. Wellesley Harris, M.R.C.S., D.P.H.

27 Th. Inspection and Demonstration at John Knight & Sons' Soap Works, Silvertown, at 3 p.m.

28 F. Lecture to School Teachers at 7 p.m. "Food and Clothing," by Col. J. Lane Notter, R.A.M.C.

28 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by A. Wellesley Harris, M.R.C.S., D.P.H.

29 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

29 S. Demonstration—Meat Inspectors' Course at 2 p.m.

MEMBERS AND ASSOCIATES ELECTED.

MEMBERS.

* Passed Examination in Sanitary Science as applied to Buildings and Public Works.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

2107 1906. July. BARCLAY, William Bowie, L.R.C.P., L.R.C.S., D.P.H. (*M.O.H.*), *Municipal Offices, Weymouth.*

2108 1906. July. BERRIDGE, Harold Meredith King, *Council Offices, Long Eaton, Derbyshire.*

2109 1906. July. BUTTERWORTH, George Ludvic, *Birchington, Isle of Thanet.*

2110 1906. July. CHAUSSÉ, Alcide, M.P.Q.A.A., *President, Province of Quebec Association of Architects, Montreal, Canada.*

2111 1906. July. DECARIE, Jean P., M.D., 501, *rue Sherbrooke, Montreal, Canada.*

2112 1906. July. DODD, Frederick Lawson, M.R.C.S., L.R.C.P., L.D.S., D.P.H., 41, *Wimpole Street, W.*

2113 1906. July. FORREST, George Topham, *Pearl Buildings, Newcastle-on-Tyne.*

2114 1906. July. *GIDLEY, Hubert John William, *Sanitary Inspector, Victoria, Hong Kong.*

2115 1906. July. HALLER, James Cracroft, *Conway House, Carlton, near Nottingham.*

2116 1906. July. HARRIS, Percy M., 4, *South Wharf, Paddington, W.*

2117 1906. July. HICKSON, George Foster, A.M.INST.C.E., *Civil Engineer, Public Works Department, Perth, Western Australia.*

2118 1906. July. HOPE, William More, D.P.H. (*M.O.H.*), 55, *Barton Street, Gloucester.*

2119 1906. July. HUTCHINSON, John A., M.D., L.R.C.P., *Physician, Westmount, Quebec.*

2120 1906. July. INGHAM, William, ASSOC.M.INST.C.E., *Civil Engineer, Port Elizabeth, S. Africa.*

2121 1906. July. JENNINGS, William, 494, *High Road, Leytonstone.*

2122 1906. July. KING, Robert, ASSOC.M.INST.C.E., *District Engineer, The Bungalow, Dundee, Natal, S. Africa.*

2123 1906. July. MCAVITY, Allan Getchel, S.B.HARVARD, *Heating and Ventilating Engineer, Montreal.*

2134 1906. July. *O'BRIEN, Patrick Joseph, 24, *Panmure Place, Edinburgh.*

2124 1906. July OLDHAM, Hugh, M.INST.C.E., *Public Works Dept., Perth, Western Australia.*

2125 1906. July. PARKER, Charles Herbert, ASSOC.M.INST.C.E., *Public Works Dept., Mergin, Burmah, India.*

2126 1906. July. *PHILLIPS, Charles, 84, *Park Avenue South, Crouch End, N.*

2127 1906. July. PLOMER, Percival Freeman Pigott, ASSOC.M.INST.C.E., *Heathwood*, 5, *Ducres Road, Forest Hill, S.E.*

2128 1906. July. REES-JONES, Edward William, M.D., D.P.H., *Medical Officer of Health, Lincoln.*

2129 1906. July. SECCOMBE, John William Smyth, D.P.H., L.R.C.P., M.R.C.S., *Royal Army Medical Corps, Devonport.*

2130 1906. July. STRINGFELLOW, William, ASSOC.M.INST.C.E., *Surveyor and Sanitary Inspector, Ashbourne, Derbyshire.*

2131 1906. July. THOMPSON, Charles Albert, M.A., M.D., M.R.C.P., M.R.C.S.E., D.P.H., 133, *Harley Street, London, W.*

2132 1906. July. *M* UNDERHILL, Thomas John, F.C.S., "*Stanley*," *Quernmore Road, Bromley, Kent.*

2133 1906. July. YOUNG, Isaac, 135, *Thurleigh Road, Balham, S.W.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
S Passed Examination in Practical Hygiene for School Teachers.

3895 1906. July. ‡BEDFORD, James Frederick, *Waterworks Engineer's Office, Leeds.*

3890 1906. July. *s* CHAPPELL, Miss Martha Ann, 72, *Park Grove, Barnsley, Yorks.*

3897 1906. July. *s* CLEGG, Thomas, *South Lane, Blackley, Elland, Yorks.*

3898 1906. July. ‡DAVIES, Thomas Edwin, 2, *Pleasant Mount, Holbeck, Leeds.*

3899 1906. July. ‡DAVY, Francis Edmund, 5, *Agnho Villas, St. John's Road, Earlswood, Surrey.*

3900 1906. July. ‡EASDALE, Thomas George, *Highways Surveyor and Inspector, East Cowton, Northallerton.*

3901 1906. July. ‡FIRTH, Herbert Goodwin, *Grande Vue, Stanningle Leeds.*
3902 1906. July. ‡FLAXMAN, Charles William, 100, *Wolseley Road, Southtown, Great Yarmouth.*
3891 1906. July. ‡FRITH, Charles Edward, *Sanitary Dept., Sanitary Board Offices, Hong Kong.*
3903 1906. July. *s* FRY, Miss Mabel Lilian, 71, *George Street, Saltair, Shipley, Yorks.*
3904 1906. July. ‡GOODALL, Herbert Samuel, 57, *Lancaster Road, Upper Edmonton, N.*
3905 1906. July. ‡GOURLAY, Norman Macleod, *Public Health Dept., P.O. Box* 1049, *Johannesburg, Transvaal.*
3906 1906. July. *s* GREENWOOD, Miss Annie, *Spa Terrace, Cragg Vale, Mytholmroyd, Yorks.*
3922 1906. July. ‡GRIFFIN, John Taylor, *Warren Road, Chingford.*
3907 1906. July. ‡KILBURN, Richard Hugh, *Surveyor and Inspector, Guisborough, Yorks.*
3908 1906. July. ‡KING, John William, 90, *Church Road, Smithhills, Bolton.*
3909 1906. July. *s* LONGBOTTOM, Abraham, *Whitehall Road, Drighlington, near Bradford.*
3910 1906. July. *s* MARTYN, Miss Gladys Winifred, 46 *Thornton Road, Thornton Heath.*
3911 1906. July. ‡MILLER, Miss Elizabeth, *Isolation Hospital, Southampton.*
3912 1906. July. ‡MILLER, John, 20, *Randolph Lane, Edinburgh.*
3913 1906. July. ‡NORTHMORE, William Phillibeer, 51, *Cecil Street, Plymouth.*
3914 1906. July. ‡O'HALLORAN, Daniel Joseph, *Sick Berth Steward, R.N., Hong Kong.*
3915 1906. July. ‡PACKER, William George, 46, *Houblon Road, Richmond.*
3923 1906. July. ‡PROSSER, Ernest Charles Camp, "*Beaufort,*" *Clarendon Road, Luton.*
3916 1906. July. *s* RELF, Miss Florence E., 2, *Granville Road, Frizinghall, near Bradford.*
3917 1906. July. *s* ROBERTS, Miss Ethel Adair, *The College of Hygiene and Physical Training, Dumfermline, N.B.*
3918 1906. July. *s* ROWBOTHAM, Miss Felicia, *Darton, near Barnsley, Yorks.*
3919 1906. July. ‡RYDER, Ernest Edward, "*Roughdown,*" *Beechcroft Road, Bushey.*
3920 1906. July. ‡SECKERSON, Frank, 348, *Stanstead Road, Catford, S.E.*
3921 1906. July. *s* SMITHSON, Miss Sarah Kershaw, 3, *Anroyd Street, Dewsbury.*
3893 1906. July. STUDHOLME, Miss Florence Mary, *Coldstream, Hinds, Canterbury, New Zealand.*
3884 1906. July. TAYLOR, George Edward, 118, *White Hart Lane, Barnes, S.W.*
3832 1906. July. WHARTON, Hugh, *Public Health Dept., Chester.*
3924 1902. Mar. WINGFIELD, S. W., 33, *Warlock Road, Paddington, W.*

GENERAL NOTES.

National Conference on Infantile Mortality,

The idea of holding national discussions concentrated on one specific subject of general importance is an excellent one, which has always received encouragement from The Royal Sanitary Institute as likely to be productive of the greatest practical good. The National Congress on Infant Mortality held in the Caxton Hall, Westminster, on the 13th and 14th June, was of this character, there being present some 450 delegates, representing 105 municipal authorities in all parts of the kingdom and 13 county councils. The Conference took place under the presidency of The Right Honourable John Burns, whose opening address consisted of a characteristic speech, with a striking appeal to glorify, dignify, and purify motherhood throughout the land. A mere glance at the titles of the numerous papers submitted, and the names of their authors, indicates the valuable nature of the gathering, and the really wide field of work which lies before the nation in dealing with this vital question in all its ramifications. It is impossible here to do more than present the ten resolutions which were passed by the Conference, but these will perhaps sufficiently portray the feeling of the meeting on the various problems under discussion. At the close of the Conference it was agreed to form an Executive Committee to give effect to the resolutions, which are as follows:—

1. "That the Education Department be urged to add instruction in Elementary Hygiene with reference to the dietary and rearing of infants to their present scheme for systematically training girls in the senior classes in the practice and principles of personal hygiene and the elements of dietary."
2. "That, in the opinion of this Conference, immediate legislation is required enabling sanitary authorities to establish or support depôts for the supply of pure, or modified, or sterilised milk, and to defray any cost out of the moneys available for public health purposes."
3. "That, in view of the information submitted, the Conference is of opinion that all still births should be notified within forty-eight hours to the medical officer of health of the district in which they occur, and that no burial should take place without a medical certificate."
4. "That notification of all births be given within forty-eight hours to the medical officer of health of the district in which they occur."
5. "That, in the opinion of this Conference, the question of the insurance of infant lives under twelve months is one demanding serious consideration; and, with a view to receiving reliable information, the Government should be asked to appoint a Departmental Committee of Enquiry on the whole question."
6. (*a*) "That the period of one month's abstention from factory work away from home now imposed on mothers be extended to at least three months, and that on their return to work, evidence must be produced

satisfactory to the local authority that proper provision has been made for the care of the child.

(b) That no employer of labour shall permit a woman advanced in pregnancy to engage in factory labour unless her ability therefore has been certified to the satisfaction of the local authority."

7. (a) "That having regard to the ascertained fact that in centres of industries where women are largely employed away from their homes an excessive number of deaths of infants takes place, and that this is contributed to by the improper conditions existing at the houses in which infants are placed out to nurse, it is necessary that the persons by whom, and the places into which infants are received, should be under supervision by the Local Sanitary Authority.

(b) That the Infant Life Protection Act be amended to remedy abuses which are not at present provided against."

8. "That all preparations offered or sold as food for infants should be certified by a Government Analyst as non-injurious, and that each packet should contain its analysis."

9. "That the Dairies, Milkshops, and Cowsheds Order is defective, and that any amendment should extend the definition of disease as applied to animals, and should make the provision of Regulations by Local Authorities compulsory. That the scope of the Regulations should be extended to cover dirty milk, and should enable Local Authorities to prohibit the sale of any milk which fails to comply with the conditions of purity agreed upon." J. R. K.

Purity of the Food Supply.

The purity of the food supply is a subject which has recently been receiving a considerable amount of public attention on account of the statements made with regard to the preparation and packing of meat for consumption. The chief remedies for the very undesirable state of things which has been disclosed, would seem to lie in the effective inspection of the premises and conduct of the business, and also the inspection of the meat and other materials used. This inspection to be of practical value, must of course be carried out by competent officers, and the training and certification of such officers is a matter which The Royal Sanitary Institute has, ever since its foundation, specially impressed upon local authorities.

In the discussions that have lately taken place in the House of Commons, the President of the Local Government Board said that he was fully aware of the need for securing that the powers of inspection possessed by local authorities should be exercised as far as possible, and in a subsequent Debate, the Secretary of State for War stated that the army officers charged with the examination of food, held certificates from Birkenhead and The Royal Sanitary Institute, and emphasised the fact that the Examination of The Royal Sanitary Institute was a very searching one.

These Examinations have been carried on by the Institute for the past six years, and are held in the principal centres in Great Britain, and have. by special request, been extended to Colonies where other Examinations are held by the Institute.

The syllabus has been very carefully arranged, and has been approved by the Local Government Board of England, the Local Government Board of Scotland, and the Local Government Board of Ireland; and the Council endeavour in every way to make the Course of Training at the Institute, and the Examination, thoroughly practical in every respect.

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in relation to Hygiene and Preventive Medicine.

"ENGINEERING RECORD." Investigations of the Effect on Man of High Air Pressures. 30th June, 1906, p. 796.

Description of experiments in connection with the effect of air pressure in deep diving and caisson working.

Hygiene of Special Classes, Trades, and Professions. and Municipal Administration.

"ENGINEERING RECORD." A Model New Abattoir in New York City. 30th June, 1906, p. 786.

Illustrated description of model abattoir and plant. The main building is 98 ft. by 125 ft., and five stories high above ground floor, the stock pens being on the top. The capacity is 2,800 cattle per day slaughtered and dressed. Details are given in subsequent numbers.

HYDE, CHARLES GILMAN. The Structural, Municipal, and Sanitary Aspects of the Central Californian Catastrophe. [Earthquake.] *Engineering Record*, 23rd June, 1906, p. 765.

Description of the interference with the water supply, collection of refuse, and general sanitation.

SIMMONS, T. B. The Housing of the Working Classes. *Journ. Inst. San. Eng.*, Vol. IX., Part I., 1905, pp. 43–48.

General, referring specially to suburbs of London, with discussion.

Building Materials, Construction, and Machinery.

"ENGINEERING RECORD." A Comparison of Formulas for Concrete Beams. 5th May, 1906, p. 568.

A comparison of formulas by nine different authorities applied to the same beam.

SCOTT, A. A. H. The Planning and Construction of Factory Buildings, with special regard to the application of Armoured Concrete. *Journ. Inst. San. Eng.*, Vol. IX., Part II., 1906, p. 34.

Refers to Ventilation, Lighting, Heating, Water-supply, and Drainage (pp. 46–48).

MEETINGS HELD.

Examinations.

Sanitary Science as applied to Buildings and Public Works.

Norwich, July 27th and 28th; 3 Candidates; 2 Certificates granted.

Inspectors of Nuisances.

Norwich, July 27th and 28th: 31 Candidates; 11 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Archer, William Henry. Hutley, Edward.

Inspectors of Nuisances.

Bannerman, David Black.
Blower, Robert Thomas.
Canham, Garfield Ewart.
Cobb, William.
Cox, Charles Leslie.
Emett, Joseph Parr.
Hodgson, Helen Sarah Cooper.
Lloyd, William Thomas.
Meyler, Sydney Jason.
Mitchell, Mary Colquhoun.
Rouse, Francis James.

FORTHCOMING MEETINGS.

Sessional Meetings.

Belfast, October 5th and 6th.—"The Sanitary History of Belfast for the Past Thirty Years," by Conway Scott, Executive Sanitary Officer.

Brighton, October 27th.—Discussion on "Co-ordination of Measures against Tuberculosis," to be opened by Sir Wm. Broadbent, Bart.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances under the Public Health Act, 1875—

Belfast, October 5th and 6th.
Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

Inspectors of Meat and other Foods—

Newcastle, October 26th and 27th.

In Hygiene in its bearing on School Life—

Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

Lectures to Sanitary Officers.

The Forty-second Course of Lectures and Demonstrations to Sanitary Officers will commence on Monday, September 10th. The Lectures are arranged to include the subjects scheduled for the examination for Inspector of Nuisances held by The Royal Sanitary Institute and the

Sanitary Inspectors' Examination Board (formed by The Sanitary Institute and other bodies).

Lectures on Sanitary Science as applied to Buildings and Public Works.

A Course of Lectures has been arranged to assist those desiring instruction in Sanitary Science as applied to Buildings and Public Works, suitable to Foremen of Works, Builders, and those engaged in Allied Trades, Managers of Property, Teachers and Lecturers, and others who are desirous of obtaining the Certificate of the Institute in Sanitary Science as applied to Buildings and Public Works.

Inspections and Demonstrations are arranged, and include visits to Disinfecting Stations, Municipal Depots, Artizans' Dwellings, Waterworks, Sanitary Works in Progress, Refuse and Sewage Disposal Works, etc., etc., and other Public and Private Works illustrative of Sanitary Practice and Administration.

The Course will commence on September 28th.

Course of Lectures on Hygiene in its bearing on School Life.

This Course of Lectures has been arranged to assist Teachers and others interested in the training of children and the structural conditions of the school, who purpose entering for the Examination of the Institute in Hygiene in its bearing on School Life.

The Second Course will commence on September 17th.

Course of Practical Training for Meat Inspectors

for candidates preparing for the Examination for Inspectors of Meat and Other Foods, conducted by The Royal Sanitary Institute.

The Seventh Course will commence on September 21st, and will consist of systematic Practical Training in the Inspection of Meat at a Cattle Market, including Demonstration on live cattle and sheep, slaughtering and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangements of markets and byres, etc.

Demonstration will also be arranged at a knacker's yard, where instruction regarding the flesh and organs of the horse will be given.

The Course will continue for two months.

Demonstrations will be given at the Institute on Friday evenings and at a Market on Saturday afternoons.

In addition to the Practical Training at a Market, the Course will include the Lectures on Meat and Food Inspection given in the Parkes Museum.

Special Course on Food and Meat Inspection.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Students preparing for the Examination for Inspectors of Meat and other Foods, conducted by The Royal Sanitary Institute, will commence on November 12th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

CALENDAR, SEPTEMBER AND OCTOBER, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

SEPTEMBER.

10 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

12 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

14 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

15 S. Inspection and Demonstration of Wimbledon Sewage Works, at about 2.45 p.m. Conducted by C. H. Cooper, M.INST.C.E., Borough Engineer and Surveyor.

17 M. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

17 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by G. Newman, M.D., D.P.H., F.R.S.E., M.O.H., Finsbury.

19 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

19 W. Demonstration in the Parkes Museum, at 6 p.m., Building Materials and Construction, by the Director, E. White Wallis, F.S.S.

19 W. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B.

19 W. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General B: Indoor, by G. Newman, M.D., D.P.H., F.R.S.E.

21 F. Lecture. Meat Inspectors' Course at 6.30 p.m.

21 F. Lecture to School Teachers, at 7 p m. "Physiology," by Prof. H. R. Kenwood, M.B.

21 F. Demonstration in the Parkes Museum, at 6 p.m., Baths and Lavatories, by the Director, E. White Wallis, F.S.S.

21 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by G. Newman, M.D., D.P.H.

22 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at about 2.30 p.m.

24 M. Demonstrations in the Parkes Museum, at 6 p.m., Waste Preventers and Water Closets, by the Director, E. White Wallis, F.S.S.

24 M. Lecture to Sanitary Officers at 7 p.m. Infectious Diseases, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H. Lewisham,

26 W. Demonstration in the Parkes Museum, at 6 p.m., Pipe Joints, etc., and Drain Testing Appliances, by the Director, E. White Wallis, F.S.S.

26 W. Lecture to Sanitary Officers at 7 p.m. Methods of Disinfection, by A. Wellesley Harris, M.R.C.S., D.P.H.

27 Th. Inspection and Demonstration at John Knight & Sons' Soap Works, Silvertown, at 3 p.m.

28 F. Lecture to School Teachers at 7 p.m. "Food and Clothing," by Col. J. Lane Notter, R.A.M.C.

28 F. Demonstration in the Parkes Museum, at 6 p.m., House Drainage, by the Director, E. White Wallis, F.S.S.

28 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by A. Wellesley Harris, M.R.C.S., D.P.H.

29 S. Demonstration—Meat Inspectors' Course at 2 p.m.

29 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

OCTOBER.

1 M. Lecture to School Teachers at 7 p.m. "Physical Exercises," by P. Boobbyer, M.D.

2 T. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper St., Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

3 W. } 4 Th. } Lecture to Sanitary Officers at 7 p.m. "Elementary Physics," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

5 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

5 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

5 F. } **Sessional Meeting,** at 8 p.m., BELFAST. "The Sanitary History of Belfast for the past Thirty Years," by Conway Scott, Executive Sanitary Officer.

6 S. } DITTO.—VISIT.

5 F. } 6 S. } Examination in Sanitary Science as applied to Building and Public Works, and for Inspectors of Nuisances, Belfast.

6 S. Inspection and Demonstration at the Aylesbury Dairy Company's premises, St. Petersburgh Place, Bayswater, W., at 2.30 p.m.

8 M. Demonstration on Water Supply in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

8 M. Lecture to School Teachers, at 7 p.m., "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

8 M. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry and Meteorology," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

10 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

10 W. Lecture—Sanitary Science Course, at 7 p.m. "Analysis of Air and Water," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

12 F. Lecture to Sanitary Officers at 7 p.m. "Calculations, Measurements, and Plans and Sections," by W. C. Tyndale, M.INST.C.E.

12 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, for
13 S. } Inspectors of Nuisances, Liverpool.

13 S. Demonstration—Meat Inspectors Course, at 2 p.m.

13 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by J. Priestley, M.D., D.P.H., Medical Officer of Health, Lambeth.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

London. *The Association of Head Mistresses.* Report, 1906. 72 pp., 8vo. London, 1906. *The Association.*

——— *The British Association for the Advancement of Science.* Report of the 75th Meeting, South Africa, August and September, 1905. List of Members, 1905. 653 pp., 8vo. London, 1906. *The Association.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings, Vol. CLXIII., 1905–6. Part I. 479 pp., 8vo. London, 1906. *The Institution.*

——— *The Surveyors' Institution.* List of Members. 223 pp., 8vo. London, 1906. *The Institution.*

Army Medical Department. Report for the Year 1904, with Appendix. Volume XLVI. 582 pp., 8vo. London, 1906. *The Department.*

Barcelona. Primer Congrés D'Hygiene de Catalunya, June, 1906. 178 pp., 4to. Barcelona, 1906.

Belfast. Infantile Mortality. An inquiry into its causes and how it may be reduced, with special reference to the City of. 50 pp., 8vo. Belfast, 1906.

Berlin. Feuerungsuntersuchungen des Vereins für Feueringsbetrieb und Rauchbehämpfung in Hamburg. 92 pp., 4to. Berlin, 1906. *F. Haier.*

Berne. Rapport du Bureau Fédéral des Assurances sur les Entreprises Privées en Matière d'Assurances, in 1904. 151 pp., 4to. Berne, 1906.

Board of Agriculture and Fisheries. Annual Reports of Proceedings under the Diseases of Animals Act, the Markets and Fairs (Weighing of Cattle) Acts, &c., &c., for the Year 1905. 105 pp., 8vo. London, 1906. *The Board.*

——— Agricultural Statistics, 1905. Report on the Agricultural returns relating to acreage and product of crops and number of livestock in Gt. Britain. with summaries for the United Kingdom, British possessions and foreign countries, and particulars of prices, imports and exports of agricultural produce. 306 pp., 8vo. London, 1906. *The Board.*

Bristol. Education Committee. Syllabus of physical exercises for use in the Committee's schools. Compiled by C. Percy Rea, Superintendent of Physical Instruction. 69 pp., 16mo. Bristol, 1906. *The Committee.*

Chicago. Biennial Report of the Department of Health for the Year 1904-5. 368 pp., 8vo. Chicago, 1906. *The Department.*

Dalgado, D. G. The Climate of Lisbon and of the two Health Resorts in its immediate neighbourhood, Mont 'Estorel on the Riviera of Portugal, and Cintra. 50 pp., 8vo. London, 1906.

Elliott, *M., and* **Elliott,** *G., M.R.C.S., D.P.H.* The Public Health Acts and other Sanitary Laws and Regulations. Specially prepared for the Diploma of Public Health. 158 pp., 8vo. London, 1906. Price 5s. *H. K. Lewis (Publisher).*

Factories and Workshops. Annual Report of the Chief Inspector for the year 1905. 447 pp., fcp. London, 1906. *The Chief Inspector.*

Geological Survey of England and Wales. Memoirs: Explanation of Sheets 326 and 340. The Geology of the Country near Sidmouth and Lyme Regis. By H. B. Woodward, F.R.S., and W. A. E. Ussher, F.G.S. 96 pp., 8vo. London, 1906.

——— The Water Supply of Suffolk from Underground Sources: with records of sinkings and borings. By W. Whitaker, F.R.S. 177 pp., 8vo. London, 1906.

——— Memoirs: Soils and Subsoils from a Sanitary Point of View, with especial reference to London and its neighbourhood, by H. B. Woodward, F.R.S. Second Edition. 82 pp., 8vo. London, 1906. *His Majesty's Government.*

Gordon, *M. H., M.D., B.Sc.* Report on an Investigation of the Ventilation of the Debating Chamber of the House of Commons. 212 pp., fcp. London, 1906. *His Majesty's Government.*

Greenwich Royal Observatory. Magnetical and Meteorological Observations, 1904. 143 pp., 4to. Edinburgh, 1905. *The Astronomer-Royal.*

Japan. Annual Report of the Health of the Imperial Navy for the year 1903. 161 pp., 8vo. Tokio, 1906.

Leipzig. Sechsundrieszigster Jahresbericht des Königl. Landes-Medizinal Kollegiums über das Medizinalwesen in Königreiche Sachsen, auf das Jahr 1904. 401 pp., 8vo. Leipzig, 1906.

Local Government Board. Report on Further Experiments on Sulphur Dioxide, as applied in the Destruction of Rats and in Disinfection on Shipboard. By John Wade, D.Sc. No. 232. 48 pp., fcp. London, 1906.

——— Dr. S. W. Wheaton's Report upon the Sanitary Circumstances and Administration of the Narberth Rural District, No. 233. 11 pp., fcp. London, 1906.

——— Dr. F. St. George Mivart's Report on the General Sanitary Circumstances and Administration of the Urban District of Royston (Yorkshire), and upon the Prevalence of certain Infectious Diseases therein, No. 234. 13 pp., fcp. London, 1906.

——— Index to the Reports of the Medical Officers issued during the Years 1891–92 to 1903–04. Prepared by A. A. Mussen, M.D., D.P.H., and W. Hanna, M.B., D.P.H. 99 pp., 8vo. Liverpool, 1906.

——— Dr. R. Farrar's Report on the Sanitary circumstances and Administration of the Valley Rural District, Anglesey. No. 235. 8 pp., fcp. London, 1906.

——— Dr. L W. Darra Mair's Report to the Local Government Board on the Sanitary Circumstances and Administration of the Rural District of Pocklington. No. 236. 13 pp., fcp. London, 1906.

——— Dr. H. Timbrell Bulstrode's Report to the Local Government Board, upon a re-inspection with Dr. R. Farrar, of the Durham Rural District. No. 237. 9 pp., fcp. London, 1906. *W. H. Power, C.B., F.R.S.*

London. Infantile Mortality, National Conference on. Report of the Proceedings of the Conference held in the Caxton Hall, Westminster, on the 13th and 14th June, 1906. 314 pp., 8vo. London, 1906. *Messrs. P. S. King & Son.*

——— Law Reports. Five years' Digest, 1901–1905, of all the cases reported in the Law Reports and in the Weekly Notes, from the commencement of 1901 to the end of 1905. 1,613 pp., 8vo. London, 1906. *The Incorporating Council of Law Reporting for England and Wales.*

——— Tuberculosis (International Congress of 1905). Copy of report of C. T. Williams, M.A., M.D., F.R.C.P., and H. T. Bulstrode, M.A., M.D., D.P.H., the Delegates of His Majesty's Government to the International Congress on Tuberculosis, held at Paris from the 2nd to the 7th October, 1905. 39 pp., 8vo. London, 1906.

——— Seventh International Congress of Architects, London, 16th–21st July, 1906, under the auspices of the Royal Institute of British Architects. Abstract of Papers. 95 pp., 4to. London, 1906. *The Royal Institute of British Architects.*

Lovibond, J. W. An Introduction to the Study of Colour Phenomena, explaining a new theory of colour based entirely on experimental facts, with applications to scientific and industrial investigations. 48 pp., 8vo. London, 1905. *The Author.*

Manitoba. *The Historical and Scientific Society of.* The Moose and Wapiti of Manitoba, a plea for the preservation, by J. P. Turner. 8 pp., 8vo. Winnipeg, 1906.

——— *The Historical and Scientific Society of.* A Great City Library, by G. Bryce, LL.D., F.R.S.C. 8 pp., 8vo. Winnipeg, 1906.

——— *The Historical and Scientific Society of.* Annual Report for the year 1905. 7 pp., 8vo. Winnipeg, 1906.

——— *The Historical and Scientific Society of.* The Galicians Dwelling in Canada and their Origin, by M. A. Sherbinin, B.Sc. 10 pp., 8vo. Winnipeg, 1906. *The Society.*

Marriott, *W., F.R.Met.Soc.* Some Facts about the Weather. 32 pp., 8vo. London, 1906. *W. Marriott, F.R.Met.Soc.*

Mersey and Irwell Joint Committee. Report (May, 1906), by R. A. Tatton, M.Inst.C.E., Chief Inspector. 15 pp. 8vo. Manchester, 1906. *R. A. Tatton, M.Inst.C.E.*

Metropolitan Asylums Board. Annual Report for the year 1905. 320 pp., 8vo. London, 1906. *The Board.*

Michigan. *State Board of Health.* Report of the Secretary for the year ending June 30th, 1904. 221 pp., 8vo. Michigan, 1905. *The Board.*

Moor, *C. G., M.A., F.I.C.*, and **Hewlett.** *R. T., M.D., D.P.H.* Applied Bacteriology. Third Edition. An Elementary Handbook for the use of Students of Hygiene, Medical Officers of Health, and Analysts. 475 pp., 8vo. London, 1906. *Baillière, Tindall, & Cox.*

New South Wales. Report of the Board of Health on Leprosy in New South Wales for the year 1905. 19 pp., fcp. Sydney, 1906. *Ashburton Thompson, M.D., D.P.H.*

Philadelphia. Transactions of College of Physicians. Volume 27. 252 pp., 8vo. Philadelphia, 1905. *The College.*

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

MEMOIRS OF THE GEOLOGICAL SURVEY, ENGLAND AND WALES.*

Although 24 pages larger than the first edition, the price is much less. The chief additions are in the chapter on Water-supply and Drainage. The main object of the work is to assist in the choice of a place of residence; but naturally many other subjects are treated of.

The various subsoils are described from a lithologic rather than a stratigraphic standpoint. After made ground and alluvium, the various gravels and sands are described, then mixed subsoils, then clays, and then the Chalk. Remarks follow on the subsoil, with reference to sites, etc. Water-supply is treated under two heads, London and Rural. This is followed by a chapter on Sanitary considerations in regard to situation of houses, in which meteorologic conditions are noticed. With strict appropriateness the last chapter is devoted to cemeteries.

The index (of 12 pages) is very elaborate, and shows at a glance on what geologic formations each place stands: this is done by means of letters. The principal heights are also given.

In the capital map, no less than 15 divisions of subsoils are very clearly shown by colours, 7 being grouped in the clayey series, 3 in the gravelly, and 3 in the sandy, with marshland as vanguard, and chalk as rearguard.

The work is a most useful one, and should have a rapid sale. W. W.

LOCAL GOVERNMENT BOARD INDEX.†

This is a continuation of the Index to the Reports of the Medical Officers, which was initiated by Dr. J. B. Russell, and compiled by Drs. Marsh and Irvine, from 1858 to 1893.

It includes references to the thirteen annual volumes issued by the Medical Officers from 1891–92 to 1903–04. Each volume is indicated by the year to which the contained Report refers, the subsequent figures referring to the pages.

As in former years, the Medical Officer has from time to time submitted to the Local Government Board as additional Supplements to his Annual Reports, special reports on important subjects, such as "Cholera," "Plague," "Lead Poisoning and Water Supplies," etc. A list of those published during the years in question is given, with the date of publication, and, in some cases, a short synopsis of the contents. References to the more important reports and papers contained in these Supplements are also included in the Index.

* Local Government Board Index to the Reports of the Medical Officers, issued during the years 1891-92 to 1903-4, prepared by A. A. Mussen, M.D., D.P.H., Assistant Medical Officer of Health, City of Liverpool, and W. Hanna, M.A., M.D., D.P.H., Assistant Medical Officer of Health, Port of Liverpool. 99 pp., 8vo. Liverpool, Tinkling & Co.

† Memoirs of the Geological Survey, England and Wales. Soils and Subsoils from a Sanitary Point of View, with especial reference to London and its Neighbourhood, by H. B. Woodward., F.R.S. Ed. 2. pp. vi., 82, plate (coloured map). Price 1s. 6d., 8vo. London, 1906.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in relation to Hygiene and Preventive Medicine.

CHILVERS, GEO. W., F.R.Met.Soc. Meteorology in its bearing on Sanitary Science and Engineering. *Surveyor*, 4th May, 1906, pp. 489–90.

Definitions. The study of Meteorology. Water supply. Sewerage and sewage disposal. Construction of dwellings. Ventilation. Heating. Lighting. Roads and streets. Smoke and fog.

Hygiene of Special Classes, Trades, and Professions and Municipal Administration.

FREEMAN, ALBERT C. Crematoria and Columbaria. *Building News*, 19th Jan., 1906, pp. 87–8.

General practice of the Ancients, practical considerations. Descriptions of various Crematoria. Cost.

CADELL, HENRY M., B.Sc. The Garden City Question in Scotland. *Surveyor*, 23rd Feb., 1906, pp. 254–5.

Comparison of English and Scotch requirements. Suitable industries. Rentals. Cost of houses. Concrete construction.

GRAY, C. CURTIS. Garden Cities. *Surveyor*, 16th Feb., 1906, pp. 230–31.

Descriptions of Garden Cities at Letchworth and Cardiff. Hampstead Garden Suburb. General remarks.

THOMPSON, JAMES. The Sanitation of Southend-on-Sea. *Journ. Inst. San. Eng.*, Vol. IX., Part I., 1905, pp. 30–42.

A general account, with discussion.

Water Supply, Sewerage, and Refuse Disposal.

COOPER, C. H., M.Inst.C.E. The Water Supply of the Wimbledon District. *Surveyor*, 30th March, 1906. Supplement.

Early methods of supply. General history. Ancient supply to Hampton Court. Artesian Wells.

"ENGINEERING RECORD." The Sewerage System of New Orleans. 26th May, 1906, p. 640.

First article on the planning and construction of the sewerage of the city with a population of 325,000.

——— Experiments with Tar and Oil for Roads at Jackson, Tenn. 30th June, 1906, p. 800.

Mode of application, cost, and results.

FRANCOU, MONS. The Sterilization and Filtration of Water Supplies. *Surveyor*, 5th Jan., 1906, p. 9.

Water supply of the French town, Lectoure. The "Ferrochlor" Sterilizer. Description of the installation. Cost. The apparatus.

FULLER, GEORGE W. Notes on Sprinkling Filters for Sewage Treatment. *Engineering Record*, 23rd June, 1906, p. 756.

Historical notes and description of sprinkling filters as compared with contact filters.

HAZEN, ALLEN. The Disposal of the Sewage of Paterson, N.J. *Engineering Record*, 11th Aug., 1903, p. 144.

Illustrated description of the treatment of municipal sewage containing a large amount of mill matter.

FORTHCOMING MEETINGS.

SESSIONAL MEETINGS.

Belfast, October 5th and 6th, 7.30 p.m.—Discussion on "The Sewage Purification Problem, with special reference to Sewage Discharge into a Tidal Estuary," by Jas. D. Williamson, M.D., M.Ch., M.A.O., R.U.I. Visits will be made to the Corporation Pumping Station, Sewage Outfall Works, and the New Infectious Diseases Hospital.

Brighton, October 27th, 11 a.m.—Discussion on "Co-ordination of Measures against Tuberculosis," to be opened by Sir Wm. Broadbent, Bart., K.C.V.O., LL.D.

EXAMINATIONS.

In Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances under the Public Health Act, 1875—

Belfast, October 5th and 6th.
Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

Inspectors of Meat and other Foods—

Newcastle, October 26th and 27th.

In Hygiene in its bearing on School Life—

Liverpool, October 12th and 13th.
Nottingham, October 19th and 20th.

SPECIAL COURSE ON FOOD AND MEAT INSPECTION.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Men preparing for the Examination for Inspectors of Meat and other Foods, conducted by The Royal Sanitary Institute, will commence on November 12th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

CALENDAR, OCTOBER AND NOVEMBER, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee **Congress and Editing Committee**	**Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.**
Examination Committee Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee **Finance Committee**	**Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.**
Parliamentary Committee New Premises Committee **Disinfectant Standardisation Committee**	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

OCTOBER.

2 T. **Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper St., Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.**

3 W. / 4 Th. **Lecture to Sanitary Officers at 7 p.m. "Elementary Physics," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.**

5 F. **Lecture—Meat Inspectors' Course, at 6.30 p.m.**

5 F. **Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.**

5 F. **Sessional Meeting, at 7.30 p.m., BELFAST.—Discussion on "The Sewage Purifition Problem, with special reference to Sewage Discharge into a Tidal Estuary," by Jas. D. Williamson, M.D., M.CH., M.A.O., R.U.I.**

6 S. **VISITS will be made to the Corporation Pumping Station, Sewage Outfall Works, and the New Infectious Diseases Hospital, Belfast.**

5 F. / 6 S. **Examination in Sanitary Science as applied to Building and Public Works, and for Inspectors of Nuisances, Belfast.**

6 S. **Inspection and Demonstration at the Aylesbury Dairy Company's premises, St. Petersburgh Place, Bayswater, W., at 2.30 p.m.**

8 M. Demonstration on Water Supply in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

8 M. Lecture to School Teachers, at 7 p.m., "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

8 M. Lecture to Sanitary Officers at 7 p.m. "Elementary Chemistry and Meteorology," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

10 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

10 W. Lecture—Sanitary Science Course, at 7 p.m. "Analysis of Air and Water," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

12 F. Lecture to Sanitary Officers at 7 p.m. "Calculations, Measurements, and Plans and Sections," by W. C. Tyndale, M.INST.C.E.

12 F. }
13 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, Liverpool.

13 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

13 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by J. Priestley, M.D., D.P.H., Medical Officer of Health, Lambeth.

15 M. Lecture to School Teachers at 7 p.m. "School Furniture," by Prof. H. R. Kenwood, M.B., D.P.H.

15 M. Lecture to Sanitary Officers at 7 p.m. "Building Materials," by A. Saxon Snell, F.R.I.B.A.

17 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt. Public Health Department, Borough of Islington.

17 W. Lecture to Sanitary Officers at 7 p.m. "Sanitary Building Construction," by A. Saxon Snell, F.R.I.B.A.

17 W. Lecture to School Teachers at 7 p.m. "Physical Exercises," by P. Boobbyer, M.D.

19 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

19 F. Lecture—Sanitary Science Course, at 7 p.m. "Sanitary Building Construction" (Advanced), by A. Saxon Snell, F.R.I.B.A.

19 F. }
20 S. } Examinations in Practical Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Nottingham.

20 S. Inspection and Demonstration at the Camberwell Infirmary, Brunswick Square, Peckham Road, S.E., at 2.15 p.m. Conducted by Edwin T. Hall, V-P.R.I.B.A.

22 M. Lecture to Sanitary Officers at 7 p.m. "Sanitary Appliances," by W. C. Tyndale, M.INST.C.E.

24 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Kemble Street, Drury Lane, W.C., at 3 p.m.

24 W. Lecture to Sanitary Officers at 7 p.m. "Details of Plumbers' Work," by J. Wright Clarke.

26 F. Lecture to Sanitary Officers at 7 p.m. "Ventilation, Warming, and Lighting," by A. Saxon Snell, F.R.I.B.A.

26 F. }
27 S. } Examination for Inspectors of Meat and other Foods, Newcastle.

27 S. **Sessional Meeting**, at 11 a.m., BRIGHTON. Discussion on "Co-ordination of Measures against Tuberculosis," to be opened by Sir Wm. Broadbent, Bart., K.C.V.O., LL.D.

27 S. Demonstration—Meat Inspectors' Course at 2 p.m.

27 S. Inspection and Demonstration at Marylebone Workhouse, and Public Baths, at 3 p.m. Conducted by A. Saxon Snell, F.R.I.B.A.

29 M. Lecture to Sanitary Officers at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.

31 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

31 W. Lecture to Sanitary Officers at 7 p.m. "Water Supply; Sources of Supply and Distribution," by J. E. Worth, M.INST.C.E.

NOVEMBER.

2 F. Lecture—Meat Inspectors' Course at 6.30 p.m.
2 F. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D
2 F. Lecture to Sanitary Officers at 7 p.m. "Water Composition," by A. Wellesley Harris, M.R.C.S., D.P.H.
2 F. } 3 S. } Examination in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Aberdeen.
5 M. Lecture to Sanitary Officers at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.
7 W. Inspection and Demonstration at a Factory Building, at 3 p.m. Conducted by H. D. Searles-Wood, F.R.I.B.A.
7 W. Lecture to Sanitary Officers at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.
7 W. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D., D.P.H.
7 W. Lecture to Sanitary Officers at 7 p.m. "Scavenging," by J. E. Worth, M.INST.C.E.
9 F. } 10 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Newcastle-on-Tyne.
10 S. Demonstration—Meat Inspectors' Course at 2 p.m.
12 M. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.
12 M. Lecture to Sanitary Officers at 7 p.m. "Signs of Health and Disease in Animals destined for food, when alive and after slaughter. Tuberculin and other Tests," by W. Hunting, F.R.C.V.S.
13 T. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.
13 T. Lecture—Meat Inspectors' Course, 6.30 p.m.
14 W. Lecture to Sanitary Officers at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by W. Hunting, F.R.C.V.S.
15 Th. Demonstration to Commissioned Officers and Professional Men, at the Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.
16 F. Lecture to Sanitary Officers at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.
16 F. Lecture to Sanitary Officers at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by W. Hunting, M.R.C.V.S.
17 S. Demonstration—Meat Inspectors' Course at 2 p.m.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, for May and June, 1906 .. *Prof. Matthew Hay, M.D.*
Bethnal Green, 1905 .. .. *G. P. Bate, M.D., F.R.C.S.*
Birkenhead, 1905 .. .. .. *R. Sydney Marsden, D.Sc., D.P.H., F.R.S.*
Birmingham, 1905 .. .. .. *J. Robertson, M.D., B.Sc.*
Birmingham (Report of the Housing Committee), 1906 .. .. .. *J. Robertson, M.D., B.Sc.*
Cardiff, 1905 .. .. *E. Walford, M.D., D.P.H.*
Carnarvonshire (Combined Sanitary Districts), 1905 .. .. .. *P. Fraser, M.D., B.Sc.*
Chester C.C., 1905 .. .. .. *F. Vacher, F.R.C.S., M.R.C.P.*
Cleethorpes-with-Thranscoe, 1905 .. *T. Newby, M.D.*

Derby, 1905	*W. J. Howarth, M.D., D.P.H.*
Dunbarton (C.C.), (San. Ins.) 1905	*D. Dunbar.*
Edinburgh, 1905	*Sir Henry Littlejohn, M.D., LL.D.*
Essex C.C., 1905	*J. C. Thresh, D.Sc., M.D., D.P.H.*
Gloucester C C., 1905	*J. Middleton Martin, B.A., M.D., D.P.H.*
Greenwich, 1905	*E. G. Annis, M.R.C.S., D.P.H.*
Hackney, 1905	*J. King Warry, M.D., M.R.C.P.*
Handsworth U.D.C., 1905	*J. Richmond, M.A., M.D., D.P.H.*
Hereford, 1905	*H. Cecil Moore, M.R.C.S., L.S.A.*
Hertfordshire C.C., 1905	*F. E. Fremantle, F.R.C.S., D.P.H.*
Ilfracombe, 1905	*E. J. Slade-King, M.D., D.P.H.*
Kensington, 1905	*T. Orme Dudfield, M.D.*
Kimberley, (**San. Dept.**), 1905 ..	*J. S. Dunn.*
Lanark C.C., 1905	*J. T. Wilson, M.D., D.P.H.*
Lewisham, 1905	*A. W. Harris, M.R.C.S., D.P.H.*
Liverpool, 1905	*E. W. Hope, M.D., D.Sc.*
London (City of), four weeks ending 12th May, five weeks ending 16th June, and four weeks ending 14th July, 1906	*W. Collingridge, M.D., D.P.H.*
Lowestoft, 1905	*A. Marshall.*
Newcastle-upon-Tyne, 1905 ..	*H. E. Armstrong, D.Hy.*
Newport Port Sanitary Authority, 1905	*J. Howard Jones, M.D., D.Sc. C.M.*
Northamptonshire C.C., 1905 ..	*C. E. Paget, M.R.C.S., D.P.H.*
Nottinghamshire C.C., 1905 ..	*H. Handford, M.D., D.P.H.*
Paddington, 1905	*R. Dudfield, M.B., D.P.H.*
Poplar, 1905	*F. W. Alexander, M.R.C.S., D.P.H.*
Preston, 1905	*H. O. Pilkington, M.R.C.S.*
Richmond, 1905	*J. H. Crocker, M.D., D.P.H.*
Salford, 1905	*C. H. Tattersall, L.R.C.P., M.R.C.S.*
Shanghai, 1905	*A. Stanley, M.D., B.S.Lond., D.P.H.*
Stepney, 1905	*D. L. Thomas, M.R.C.S., D.P.H.*
St. Helens, 1905	*J. J. Buchan, M.D., D.P.H.*
Stockport, 1905	*Meredith Young, M.D., D.P.H.*
Sunderland, 1905	*H. Renney, M.D., D.P.H.*
Surrey C.C., 1905	*E. C. Seaton, M.D., F.R.C.P.*
Westminster, 1905	*F. J. Allan, M.D., D.P.H., F.R.S.Edin.*
Wiltshire C.C., 1905	*J. Tubb-Thomas, L.R.C.P., D.P.H.*
Wolverhampton, 1905	*H. Malet, B.A., M.D.*
Woolwich, 1905	*S. Davies, M.D., D.P.H.*

In addition to the books presented to the Library, the following works connected with Sanitary Science have been published:—

Blackham, *R. J., D.P.H., Capt. R.A.M.C.* The Care of Children: Practical Hints for Mothers and Nurses at Home and Abroad. London: The Scientific Press, Ltd.

Brock, *W. J., D.Sc., M.B., F.R.S.* Sanitary Laws of Scotland and Principles of Public Health. Oliver & Boyd, Edinburgh and London.

Cantlie, *J., M.A., M.B., D.P.H.* Physical Efficiency. London and New York: G. P. Putnam's Sons. 1906.

Curtis, *E., M.D.* Nature and Health: A Popular Treatise on the Hygiene of the Person and the Home. New York: H. Holt & Co. 1906.
Drinkwater, *H., M.D.* Food in Health and Disease. London: J. M. Dent & Co. 1906.
Edinburgh. The Edinburgh Stereoscopic Atlas of Anatomy. Editor, D. Waterson, M.A., M.D. T. C. & E. C. Jack. 1906.
Elkington, *H. R. G., Lt.-Col., R.A.M.C.* Notes on Military Sanitation. London: St. John's Ambulance Association. 1906.
Grimshaw, *J., M.D., D.P.H.* Health Talks about Children: An appeal for the Child. Birkenhead: Brimmell's Printing Works. 1906.
Hasluck, *Paul N.* Builders' Work in its Legal Aspect. Cassell & Co.
Howells, *W. H., M.D.* Text-book of Physiology for Medical Students and Physicians. London and Philadelphia: W. B. Saunders & Co. 1905.
London. Recent Advances in Physiology and Bio-Chemistry. Edited by L. Hill, M.B. E. Arnold. 1906.
Monro, *T. K., M.A., M.D.* Manual of Medicine. 2nd Edition. London: Baillière, Tindall, & Cox. 1906.
Newman, *G., M.D., D.P.H.* Infant Mortality: A Social Problem. London: Methuen & Co. 1906.
——— Text-book of Anatomy. Editor, D. J. Cunningham, F.R.S. London and Edinburgh: T. J. Pentland. 1906.
Poley, *Arthur P., B.A.* The Law affecting Drains and Sewers. Eyre and Spottiswoode.
Sabin, *Louis-Carlton, B.S., C.E.* Cement and Concrete. A. Constable & Co.
Sayers, *A.* Experiments on Hot-water Systems. London: San. Pub. Co. 1906.
Stacpole, *Florence.* A Healthy Home and How to Keep it. Wells, Gardner, Darton, & Co., London.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905.	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	119	11	0

Contributions since last Report.

	£	s.	d.
G. A. Pingstone	1	1	0
T. G. Harris ... ... during three years	1	11	6
S. Long		10	6
City of Nottingham	25	0	0

Sept. 25th, 1906.

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Water Supply, Sewerage, and Refuse Disposal.

JOHNSON, REV. W. Geology: Handbook to York and District, prepared for the British Association, 1906, p. 259.

Gives three well-sections on plate and p. 265.

KINNICUTT-LEONARD, PROF. P. The Sanitary Value of a Water Analysis. *Surveyor*, 20th April, 1906, p. 438; 27th April, 1906, p. 464.

Normal and polluted waters. Value of survey. Nitrogen content of a water. The seasonal variation. Combined chlorine. Bacterial analysis. The colon bacillus. Ground waters. Artesian waters.

LIERNUR, FRANCIS. Some Notes on the Liernur Improved Pneumatic Sewage System. *Journ. Inst. San. Eng.*, Vol. IX., Part II., 1906, p. 27.

Corrects a description of the process at Pretoria. Describes the installation at Stansted. Describes the advantages of the process.

MORGAN, E. Ll. Address on Water Supply. *Journ. Inst. San. Eng.*, Vol. IX., Part I., 1905, p. 69.

Refers to the gravitation-supplies. Treats of purification of water.

PALMER, E. R., Ventilating, Flushing, and Cleansing of Sewers and Drains. *Journ. Inst. San. Eng.*, Vol. IX., Part I., 1905, p. 49.

Deals with the cause of sewer-smells, and describes his ventilating-column, with discussion.

POLEY, ARTHUR P. Some Recent Laws on Sewage and Drains. *Building News*, 18th May, 1906, p. 697.

Decisions on Metropolitan sewers and drains. Section 19 of Public Health Amendments Act a cause of trouble. Decisions outside Metropolitan area.

WATSON, F. L., Assoc.M.Inst.C.E. Destructor By-products. *Surveyor*, 9th Feb., 1906, p. 208.

General classification of by-products. Heat. Types of boilers. Electricity. Steam. Clinker. Flue dust. Old tins. Fish manure.

WHIPPLE, GEORGE C. Disinfection as a means of Water Purification. *Engineering Record*, 28th July, 1906, p. 94.

Description of experiments at various places in the addition of chemicals to potable waters.

——— The Value of Pure Water. *Engineering Record*, 8th Sept., 1906, p. 269; 15th Sept., 1906, p. 303.

An attempt to put a money value on the various characteristics of water, with formulæ for calculating the deductions to be made on account of impurities.

SIMMONS, THOMAS B., M.R.San.Inst. Sewage Problems. *Surveyor*, 27th April, 1906, p. 462.

Schemes for treatment of sewage to depend upon local conditions. Contact beds. Sedimentation. Broad irrigation. Chemical precipitation.

Heating, Lighting, and Ventilation.

ALDOUS, F. Ventilation of Buildings. *Journ. Inst. San. Eng.*, Vol. IX., Part II., 1906, p. 18.

Discusses various details of arrangements, etc.

"ENGINEERING RECORD." Heating and Ventilating System of the New Custom House in New York. 26th May, 1906, p. 649.

Illustrated description of the plant and arrangements for heating and ventilating a seven-story granite and steel structure.

——— The Heating and Ventilation of the New Tacoma High School. 5th May, 1906, p. 561.

Illustrated description of plant and arrangements for heating and ventilating six-story building.

HUBBARD, CHARLES L. Heating and Ventilating School Houses. *Engineering Record*, 6th October, 1906, p. 386.

General review of the principles of furnace heating, and the indirect gravity system of steam heating.

MEETINGS HELD.

Sessional Meetings.

Belfast.—The meeting was held in the Council Chamber on October 5th, when a discussion on "The Sewage Purification Problem, with special reference to Sewage Discharge into a Tidal Estuary," was opened by Jas. D. Williamson, M.D., M.Ch., M.A.O., R.U.I. The chair was taken by Prof. A. Bostock Hill, M.D., D.P.H. Visits were made on Saturday, the 6th, to the Corporation Pumping Station, Sewage Outfall Works, and the New Infectious Diseases Hospital.

Brighton.—The meeting was held in the Royal Pavilion, when a paper was read on "Voluntary Notification of Phthisis in Brighton," by A. Newsholme, M.D., F.R.C.P., and a discussion on "Co-ordination of Measures against Tuberculosis," was opened by G. A. Heron, M.D., F.R.C.P. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C. A visit was made to the Sanatorium for Consumption.

Examinations.

The following Examinations were held :—

Sanitary Science as applied to Buildings and Public Works.

October 12th and 13th, Liverpool: 6 Candidates; 1 Certificate granted.

Inspectors of Nuisances.

October 5th and 6th, Belfast: 8 Candidates; 4 Certificates granted.
October 12th and 13th, Liverpool: 24 Candidates: 11 Certificates granted.
October 19th and 20th, Nottingham: 24 Candidates: 12 Certificates granted.

Hygiene in its bearing on School Life.

October 12th and 13th, Liverpool: 1 Candidate; 1 Certificate granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Moore, Frederick William.

Inspectors of Nuisances.

Beatty, Samuel.
Bond, Ernest Charles.
Catherall, William.
Crownshaw, Bertha.
Daniel, William.
du Sautoy Cathlin Cecily.
Hall, Bernard Cecil.
Halliday, John.
Hickson, Thomas.
Ingleton, William.
James, Charles Thomas.
Jones, Jessie Maud.
Keeley, Cecil John Harvey.
Kennan, William.
Lea, Walter.
Leaversuch, John William.
MacBride, Helena Steele.
Madden, Thomas Eugene.
M'Bride, Elizabeth Spence.
Nicholas, John Reginald Gordon.
Silkstone, George Rowland.
Steen, Kate.
Street, Charles.
Sutcliffe, John Edward.
Walker, James.
Ward, John Henry.
Worden, Jane.

Hygiene in its bearing on School Life.

Holland, George Frederick.

FORTHCOMING MEETINGS.

Sessional Meetings.

Malvern, December 1st, 11 a.m.—Discussion on "The Area for Sanitary Adminstration," to be opened by J. Willis Bund, Chairman, Worcestershire C.C.; and on "Progress in Works of Public Health in Malvern in recent years," by W. Osborne Thorp, Surveyor and Waterworks Engineer, Malvern U.D.C.

London, December 12th, 8 p.m.—Discussion on "Heating of Buildings by Gas in relation to Ventilation," to be opened by S. Rideal, D.Sc., F.I.C.

The following places are proposed for 1907:—Eastbourne, Plymouth, Glasgow, Stafford, Lancaster, Leeds, Leicester, Hereford, Shrewsbury, Durham, and Newcastle.

Special Course on Food and Meat Inspection.

Third Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Men preparing for the Examination for Inspectors of Meat and other Foods, conducted by The Royal Sanitary Institute, will commence on November 12th.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances under the Public Health Act, 1875—

Newcastle, November 9th and 10th.
Manchester, Nov. 30th and Dec. 1st.

In Hygiene in its Bearing on School Life—

Newcastle, November 9th and 10th.
Manchester, Nov. 30th and Dec. 1st.

Calendar, November and December, 1906.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee Finance Committee	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee New Premises Committee Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

NOVEMBER.

2 F. Lecture—Meat Inspectors' Course at 6.30 p.m.

2 F. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D.

2 F. Lecture to Sanitary Officers at 7 p.m. "Water Composition," by A. Wellesley Harris, M.R.C.S., D.P.H.

5 M. Lecture to Sanitary Officers at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.

7 W. Inspection and Demonstration at a Factory Building, at 3 p.m. Conducted by H. D. Searles-Wood, F.R.I.B.A.

7 W. Lecture to Sanitary Officers at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.

7 W. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.A., M.D., D.P.H.

9 F. Lecture to Sanitary Officers at 7 p.m. "Scavenging," by J. E. Worth, M.INST.C.E.

9 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, and
10 S. } for Inspectors of Nuisances, Newcastle-on-Tyne.

10 S. Demonstration—Meat Inspectors' Course at 2 p.m.

12 M. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

12 M. Lecture to Sanitary Officers at 7 p.m. "Signs of Health and Disease in Animals destined for food, when alive and after slaughter. Tuberculin and other Tests," by W. Hunting, F.R.C.V.S.

13 T. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

13 T. Lecture—Meat Inspectors' Course, 6.30 p.m.

14 W. Lecture to Sanitary Officers at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by W. Hunting, F.R.C.V.S.

15 Th. Demonstration to Commissioned Officers and Professional Men, at the Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.

16 F. Lecture to Sanitary Officers at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.

16 F. Lecture to Sanitary Officers at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by W. Hunting, F.R.C.V.S.

17 S. Demonstration—Meat Inspectors' Course at 2 p.m.

19 M. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

19 M. Lecture to Sanitary Officers at 7 p.m. "The Appearance and Character of Fresh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods," by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.

20 T. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

21 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

21 W. Lecture to Sanitary Officers at 7 p.m. The Hygiene of Byres, Lairs, Cowsheds, and Slaughterhouses, and all places where animals destined for the supply of food are kept, and the Hygiene of Markets, Dairies, and other places where food is stored, prepared, or exposed for sale, and transported, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.

22 Th. Inspection and Demonstration at the Metropolitan Cattle Market at 2 p.m. Conducted by James King, M.R.C.V.S.

23 F. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

23 F. Lecture to Sanitary Officers at 7 p.m. The Laws, By-laws, and Regulations affecting the inspection and sale of Meat and other articles of Food, including their preparation and adulteration, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.

24 S. Demonstration—Meat Inspectors' Course at 2 p.m.

24 S. Demonstration to Commissioned Officers and Professional Men, at 3 p.m., at Metropolitan Cattle Market, by James King, M.R.C.V.S.

26 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on Tinned and Potted Foods, by Prof. H. R. Kenwood, M.B., D.P.H.

28 W. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.

29 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Milk, Butter, Cheese, etc., by Prof. H. R. Kenwood, M.B., D.P.H.

30 F. Lecture—Meat Inspectors' Course at 6.30 p.m.

30 F. Dec. 1 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Nuisances, Manchester.

DECEMBER.

1 S. Demonstration on Meat Inspection to Commissioned Officers and Professional Men at Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.

1 S. **Sessional Meeting,** at 11 a.m. MALVERN. Discussion on "The Area for Sanitary Administration," to be opened by J. Willis Bund, Chairman of Worcestershire C.C. "Progress in Works of Public Health in Malvern, in recent years," by W. Osborne Thorp, Surveyor and Waterworks Engineer, Malvern U.D.C.

6 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa, Chocolate, and Lime-juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

7 F. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

7 F. 8 S. } Examination in Sanitary Science as applied to Building and Public Works, and for Inspectors of Nuisances, London.

8 S. Demonstration on Meat Inspection to Commissioned Officers and Professional Men at Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.

10 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

11 T. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

12 W. Visit to Factory for preparation of Concentrated and Preserved Foods.

12 W. **Sessional Meeting,** at 8 p.m., in the PARKES MUSEUM. Discussion on "Heating of Buildings by Gas in relation to Ventilation," to be opened by S. Rideal, D.SC., F.I.C.

14 F. 15 S. } Examination for Inspectors of Meat and other Foods.

25 T. 26 W. } **Christmas Day** **Bank Holiday** } Library and Museum closed.

MEMBERS AND ASSOCIATES ELECTED.

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

2160 1906. Oct. *Archer, William Henry, *Gas Works, Cromer, Norfolk.*

2135 1906. Oct. Ash, R. V. C., M.B., CH.B., D.P.H., *Causton Street, Dunfermline, Fifeshire, N.B.*

2167 1898. Dec. *‡Bellamy, H. E., *Colombo Drainage Works, Ceylon.*

2136 1906. Oct. Bullmore, Alfred William Ernest, ASSOC.M.I.M.E., *Garden City, Letchworth, Herts.*

2161 1906. Oct. *‡Chant, Frederick Charles, 25, *St. Paul's Road, Salisbury.*

2137 1906. Oct. Crook, Alfred Herbert, M.A., F.R.G.S., *Queen's College, Hong Kong.*

2138 1906. Oct. ‡Currey, William Frederick, *Public Works Dept., Pretoria, Transvaal, S. Africa.*

2168 1899. July. Davies, David Samuel, M.D., L.R.C.P., D.P.H. (*M.O.H.*), 40, *Prince Street, Bristol.*

2145 1906. Oct. Gilbert, Edwin Osborne, 40, *Bloomsbury Street, W.C.* (*Public Works Dept., Punjab, India*).

2162 1906. Oct. *Goldsmith, Henry Edward, 8, *Granville Avenue, Kowloon, Hong Kong.*

2139 1906. Oct. Harvey, Capt. Frederick, D.P.H., R.A.M.C., *c/o Holt & Co.*, 3, *Whitehall Place, S.W.*

2140 1906. Oct. Hector, William, ASSOC.M.INST.C.E., *Civil and Hydraulic Engineer, Tatura, Rodney, Victoria.*

2146 1906. Oct. Hewetson, Samuel Williamson, M.B., C.M., *Pinchers Creek, Alberta, Canada.*

2147 1906. Oct. Hossack, William Cardiff, M.B., C.M., M.D., *Plague Department, Calcutta, India.*

2163 1906. Oct. *Hutley, Edward, *Borough Engineer's and Surveyor's Office, Colchester.*

2141 1906. Oct. Jickell, Samuel, ASSOC.M.INST.C.E., *Borough Engineer, Palmerston North, New Zealand.*

2144 1906. Oct. Johnson, Frederick Edward, F.C.S., 9, *Prince Street, Hull, Yorkshire.*

2142 1906. Oct. Johnston, Charles, ASSOC.M.INST.C.E., *Jacobabad, Upper Sind, India.*

2149 1906. Oct. KATRAK, Nanabhai Navrosji, L.M.&S., *Bombay, India.*
2150 1906. Oct. KIRBY, Henry Conyers, *Drainage Engineer, Municipality of Pretoria, Transvaal.*
2113 1906. Oct. LEITCH, Donald Calder, M.INST.C.E., *P.O., Box* 1793, *Johannesburg, Transvaal.*
2151 1906. Oct. LENNANE, Gerald Quin, F.R.C.S., L.R.C.P., D.P.H. (*M.O.H.*), *Town Hall, Battersea, S.W.*
2164 1906. Oct. *LINDON, Richard, 42, *Whiteford Road, Plymouth.*
2152 1906. Oct. MOORE, James, ASSOC.M.INST.C.E.I., *Resident Engineer, Delgany Main Drainage Works, Llandaff Hall, Merrion Co., Dublin.*
2153 1906. Oct. NEECH, James T., M.D., L.R.C.P., D.P.H. (*M.O.H.*), *Town Hall, Halifax, Yorks.*
2154 1906. Oct. PEARSE, Thomas Frederick, M.D., L.R.C.S., M.R.C.P., D.P.H., 37, *Chowringhee, Calcutta, India.*
2165 1906. Oct. *RAVEN, Arthur Robert Fenton, 8A, *Droveux Road, Hong Kong.*
2155 1906. Oct. ROBINSON, Wilfred Harold, 44, *Bedford Row, W.C.*
2156 1906 Oct. S ‡SMAIL, Adam, *Local Government Board for Scotland.* 125, *George Street, Edinburgh.*
2157 1906. Oct. SUTHERLAND, Donald Slater, *Hebe Cottage, Thynne Street, West Bromwich, Staffs.*
2158 1906. Oct. SYNGE, Mrs. Ella Scarlett, M.D., L.S.A., L.M., D.P.H., 21, *Pelham Place, Thurloe Square. S.W.*
2166 1906. Oct. *TAYLOR, John, 32, *South Bank Road, Bury, Lancs.*
2159 1906. Oct. WILKINSON, Major Edmund, I.M.S., F.R.C.S., D.P.H., 26, *Montpelier Road, Ealing, W.*
2144 1906. Oct. WINTER, Lt.-Col. Thomas Bassell, R.A.M.C., M.R.C.S.E., L.S.A., D.P.H., *The Royal Army Medical Corps, Meemt U.P., India.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life (Practical Hygiene for School Teachers).

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

3026 1906. Oct. ‡ALLEN, Mrs. Annie Henrietta, *The Isolation Hospital, near Lydney, Glos.*
3027 1906. Oct. ‡BAILEY, Joseph, *Kirklands, Wood End, Shipley.*
3025 1906. Oct. BEAN, Alexander Archibald, *Alva, Clackmannan.*
3024 1906. Oct. ‡BEDFORD, Miss Sarah Mary, 14, *Other Road, Redditch, Worcester.*
3029 1906. Oct. ‡BLOWER, Robert Thomas, 4, *Merton Road, Dereham Road, Norwich.*
3030 1906. Oct. S BRACEWELL, Miss Rowena Maude, *Priestwell House. Todmorden, Yorks.*

3931 1906. Oct. ‡Bristow, Samuel Percy, 67, *Winston Road, Stoke Newington, London, N.*
3932 1906. Oct. ‡Brown, James, 71, *Celtic Road, Stockport, Chester.*
3933 1906. Oct. ‡Bush, Spencer, 37, *Church Street, Lower Edmonton, N.*
3934 1906. Oct. ‡Champion, Charles, 107, *Tressillian Road, Brockley, Lewisham.*
3935 1906. Oct. ‡Clark, Miss Thirza, 69, *Briercliffe Road, Burnley.*
3936 1906. Oct. ‡Clayton, Charles Percival Glanville, 50, *Plane Street, Newington, Hull.*
3937 1906. Oct. ‡Cobb, William, *Croydon Road, Caterham Valley, Surrey.*
3938 1906. Oct. S Cory, Lilian F. P., *Goldilands, Settle, Yorks.*
3939 1906. Oct. ‡Crowther, J., 190, *Minard Road, Hither Green, Catford, S.E.*
3940 1906. Oct. ‡Digwood, Percival John, *Alton Street, Ross, Hereford.*
3941 1906. Oct. ‡Emett, Joseph Parr, 96, *Grosvenor Road, Canonbury, N.*
3942 1906. Oct. ‡Ennor, William Henry, *City Surveyor's Office, Truro, Cornwall.*
3943 1906. Oct. S Evans, Miss Alexandra Eleanor, *Roseneath, Kidmore Road, Caversham, Oxon.*
3944 1906. Oct. ‡Fanner, Frank Alfred, 4, *Newberry Terrace, Weymouth, Dorset.*
3945 1906. Oct. Firmin, Miss Lizzie, 5, *Bushmore Road, Battersea Park, Surrey.*
3946 1906. Oct. ‡Hamar, George Wolley, *Bishop's Castle, Salop,*
3947 1906. Oct. ‡Hodgson, Miss Helen Sarah Cooper, *Baghill Hospital, Pontefruct, Yorks.*
3943 1903. Feb. ‡Horsfall, John H., 291, *Bowling Hall Road, Bradford, Yorks.*
3948 1906. Oct. ‡Horsfall, John J., 1, *Brook Street, Elland, Yorks.*
3949 1906. Oct. ‡Horspool, Miss Florence Isabella Hall, "*Riversdale,*" *Telegraph Road, Heswall, Cheshire.*
3950 1906. Oct. ‡Howarth, Lawrence, 114, *Rectory Road, Stoneyholme, Burnley.*
3951 1906. Oct. ‡Howells, James Ivor, 48, *Berkeley Road, Bishopston, Bristol.*
3952 1906. Oct. ‡Hunter, Thomas G. H., 82, *Derby Street, Ormskirk, Lancs.*
3953 1906. Oct. ‡James, Evan William, *Alltygrug Road, Ystalyfera, Glam.*
3954 1906. Oct. ‡Jenkins, John J., 130, *Churchfield Road, Acton, W.*
3955 1906. Oct. ‡Kingston, Walter George Frederick, 27, *Kelly Street, Greenock, N.B.*
3956 1906. Oct. ‡Lloyd, William Thomas, *Linden Cottage, Thames Street, Weybridge, Surrey.*
3957 1906. Oct. ‡Major, Richard, 220, *Preston Road, Brighton, Sussex.*
3958 1906. Oct. ‡McNeil, Sidney, *Tenby House, Burrows Road, Skewen, Neath, Glam.*

3959 1906. Oct. ‡MITCHELL, Miss Mary Colquhoun, *Wellington Road, Crowthorne, Berks.*
3960 1906. Oct. ‡MOORE, Frederick William, *Sea View House, Haigh, near Wigan.*
3961 1906. Oct. ‡MORGAN, Llewellyn, *Ivy Lodge, Morriston, Glam.*
3962 1906. Oct. ‡MORGAN, Morgan, 38, *High Street, Gorseinon, near Swansea, Glam.*
3963 1906. Oct. ‡MORRIS, Percy Albert, 317, *Eccles New Road, Salford, Lancs.*
3964 1906. Oct. ‡ORMESHER, Albert Henry, 11, *Devonshire Road, Liscard, Cheshire.*
3965 1906. Oct. *s* PAWSON, Harry, *School House, Micklefield, near Leeds, Yorks.*
3966 1906. Oct. ‡PINDAR, Edward Bloye, 3, *Rydal Grove, De Grey Street, Beverley Road, Hull.*
3967 1906. Oct. ‡RAYNER, Sidney Parker, 30, *Larkbere Road, Sydenham.*
3968 1906. Oct. *M* REID, Harry Avery, *Hayes Lea, Hayes Road, Bromley, Kent.*
3969 1906. Oct. ‡RICHARDS, Augustus William, 58, *High Street, Littlehampton, Sussex.*
3970 1906. Oct. ‡ROBERTS, Edgar David, 8, *Bridge Street, Neath, Glam.*
3971 1906. Oct. ‡RYAN, Thomas, 2, *Rectory Road, Devonport.*
3972 1906. Oct. ‡SMEDLEY, Albert Cecil, *c/o of Mr. F. W. Simons, Long Frie, Thame, Oxon.*
3973 1906. Oct. ‡TAYLOR, Leonard, 9, *Mark Lane, New Briggate, Leeds.*
3974 1906. Oct. THOMPSON, Benjamin Handley, 76, *Daleview Road, Stamford Hill, N.*
3975 1906. Oct. ‡THORPE, Alexander, 188, *Birchfield Road, Farnworth, Widnes, Lancs.*
3976 1906. Oct. ‡TILSTON, Joseph Herbert, 38, *Salisbury Road, Everton, Liverpool.*
3977 1906. Oct. ‡TOPHAM, Miss Harriet Emma, *Pentlandview, Liberton, Midlothian, N.B.*
3978 1906. Oct. ‡TOWLER, Joseph William, *City Hall, Cape Town, S. Africa.*
3979 1906. Oct. ‡TUCK, Frederick Grant, *Town Hall, Newtown, Sydney, N.S.W.*
3980 1906. Oct. ‡WASHINGTON, William Arthur Irving, *Hawthorn Cottage, Wombwell, Yorks.*
3981 1906. Oct. ‡WILKINS, William F., 14A, *Bells Hill, Barnet, Hertford.*
3982 1906. Oct. ‡WILLIAMS, Morgan, 21, *Oakleigh Avenue, Whitehall, Bristol.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

London. *Childhood Society.* Transactions, Vol. III., being the Proceedings of the Society for the years 1904 & 1905. 87 pp., 8vo. London, 1906. *The Society.*

——— *Royal College of Surgeons of England.* Calendar, 1906-7. 372 pp., 8vo. London, 1906. *The Council of the College.*

——— *Institution of Civil Engineers.* Charter, Supplemental Charter, By-Laws, and List of Members. 975 pp., 8vo. London, 1906.

——— *Institution of Civil Engineers.* Minutes of Proceedings, with other Selected and Abstracted Papers. Vol. CLXIV. 1905-6. Part II. 528 pp. (Plates), 8vo. London, 1906.

——— *Institution of Mechanical Engineers.* Proceedings, March-May, 1906. 360 pp. (Plates), 8vo. London, 1906. *The Institution.*

——— *Royal Institution of Great Britain.* Proceedings, Vol. XVIII., Part I., No. 99, 1906, and List of Members, 1906. 192 pp., 8vo. London, 1906. *The Institution.*

Barbadoes. *Water Works Department.* Report for the year ending 31st March, 1906. 8 pp., fcp. Barbadoes, 1906. *Geo. Lingwood, M.R.San.I.*

Baroda State. Annual Report of the Sanitary Commissioner for 1904-5. 19 pp., fcp. Baroda, 1906. *K. V. Dhurandhar, F.R.San.I.*

Bengal. Thirth-eighth Annual Report of the Sanitary Commissioner, 1905. 33 pp., fcp. Calcutta, 1906. *The Commissioner.*

Bombay. *Improvement Trust Administration.* Report for Year ending 31st March, 1906. 25 pp., fcp. Bombay, 1906. *The Trust.*

British Rainfall. Distribution of Rain—in space and the time—over the British Isles during the year 1905, by H. R. Mill, D.Sc. 271 pp., 4to. London, 1906. *The Author.*

Budapest. Székes Föváros Statisztikai Evkönyve vii. Evfolyam, 1904, szerkeszte Dr. Thirring Gusztav. 354 pp.. 4to. Budapest. *Dr. Thirring Gusztav.*

Durham. *University College of Medicine.* Calendar 1906-07. 165 pp. London, 1906. *The University.*

Cohen, *J. B., Ph.D.* The Character and Extent of Air-pollution in Leeds. 22 pp., 8vo. Leeds, 1896. *W. Whitaker, B.A., F.R.S.*

Fire Tests with Floors. A Floor of Reinforced Concrete. The Committee's report. 24 pp., 8vo. London, 1906. *The Patent Indented Steel Bar Co., Ltd.*

Geological Survey of England and Wales. Memoirs: The Water Supply (from underground sources) of the East Riding of Yorkshire, together with the neighbourhood, portions of the Vales of York and Pickering, with Records of Sinkings and Borings, by C. Fox-Strangways, F.G.S., with Contributions by H. R. Mill, D.Sc., LL.D. 181 pp., 8vo. London, 1906. *His Majesty's Government.*

Gillespie, *W. H., F.R.G.S., F.Z.S.* The argument, a priori, for the being and attributes of the Lord God, the absolute one, and first cause. 304 pp., 8vo. Edinburgh, 1906. *The Trustees of Mrs. Honyman Gillespie.*

Guy's Hospital Medical School. Calendar, 1906–1907. 100 pp., 8vo. London, 1906. *The Dean of the School.*

Hodgetts, *Chas. A., M.D.* Vaccination: What it has done; What it is; What it will do. 30 pp., 8vo. Toronto, 1906.

——— A Descriptive Article on Smallpox, with 20 illustrations, issued by the Provincial Board of Health. 9 pp. (Plates) 8vo. Toronto, 1906. *The Author.*

Huber, *J. B., A.M., M.D.* Consumption: Its relation to Man and his Civilization, its Prevention and Cure. Price 15s. 527 pp., 8vo. London, 1906. *The Publishers (J. B. Lippincott & Co.).*

Institute of Chemistry. A list of official chemical appointments held in Great Britain and Ireland, in India and the Colonies. 120 pp., 8vo. London, 1906. *The Institute.*

James, *C. C., M.Inst.C.E., F.R.Met.Soc.* Drainage Problems of the East: being a Revised and Enlarged Edition of "Oriental Drainage," Volumes I. and II. 367 pp. (plates), 8vo. Bombay, 1906. *The Author.*

Kensington, *Royal Borough of.* Record of the work carried out by the Borough Council under the Housing of the Working Classes Act, 1890 (Part 3) from Dec. 1900–June 1906. 7 pp. (plates), fcp. London, 1906. *The Borough Council.*

Kirk, *Mrs. Florence.* Old English Games and Physical Exercises. 51 pp., 4to. London, 1906. *The Author.*

Lloyd-Davies, *D. E., Assoc.M.Inst.C.E.* The Elimination of Storm-water from Sewerage Systems, and Elimination of Suspended Solids and Colloidal Matters from Sewage. By Lieut.-Col. A. S. Jones, V.C., M.Inst.C.E., and W. O. Travis, M.D. 159 pp., 8vo. London, 1906. *Lieut.-Col. A. S. Jones, V.C., M.Inst.C.E.*

Local Government Board. Dr. J. Spencer Low's report on the sanitary circumstances and administration of the borough of Batley. No. 242. 32 pp., fcp. London, 1906.

——— Dr. Reginald Farrar's report on an inquiry into the sanitary circumstances and administration of the urban district of Darlaston, in the county of Stafford. No. 243. 12 pp., fcp. London, 1906.

——— Dr. R. Farrar's Report on an Outbreak of Enteric Fever, associated in some cases with Cerebro-Spinal Symptoms, at Fincham, in the Downham Rural District, Norfolk. No. 238. 12 pp, fcp. London, 1906.

——— Mr. G. C. Hancock's Report upon the Sanitary Circumstances and Administration of the Borough of Haverfordwest, and upon the recent Prevalence of Enteric Fever therein. No. 239. 17 pp., fcp. London, 1906.

——— Dr. R. Dean Sweeting's Report on the General Sanitary Circumstances and Administration of the Tavistock Rural District, with special reference to an Outbreak of Diphtheria at Princetown. No. 240. 18 pp., fcp. London, 1906.

——— Preliminary report on the results of sustained subjection of glycerinated calf lymph to temperatures below freezing point, by Dr. Frank R. Blaxall and Mr. H. S. Fremlin. 4 pp., fcp. London, 1906.

——— Thirty-fourth Annual Report, 1904–5. Supplement, containing the report of the Medical Officer of Health for 1904–5. 420 pp. (plates), 8vo. London, 1906. *W. H. Power, C.B., F.R.S.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, July and August, 1906 ..	*Prof. Matthew Hay, M.D.*
Berkshire C.C., 1905	*G. C. Taylor, M.D., D.P.H.*
Bombay, 1905	*J. A. Turner, M.B., D.P.H.*
Bradford, 1905	*W. Arnold Evans, M.D.., B.Sc.*
Calcutta, 1905	*J. N. Cook, D.P.H.*
Glamorgan C.C., 1905	*W. Williams, M.D., D.P.H.*
Glasgow, 1905	*A. K. Chalmers, M.D., D.P.H.*
Huddersfield, 2nd quarter, 1906 ..	*S. G. Moore, M.D., D.P.H.*
London, City of, Nine weeks ending 15th September, 1906	*W. Collingridge, M.D., D.P.H.*
Manchester (Rivers Dept.), 1905–06.	*A. H. Scott* (*Chairman Rivers Committee*).
Newport (Mon.), 1905	*J. Howard-Jones, M.D., D.Sc., C.M.*
Nottingham, 1905	*P. Boobbyer, M.D., M.S.*
Oldham, 1905	*J. B. Wilkinson, M.D., D.P.H.*
Sydney (Combined San. Dists.), 1905	*W. G. Armstrong, M.B., D.P.H.*
Tasmania, 1905-06	*J. S. C. Elkington, M.D., D.P.H.*
West Riding C.C., 1905	*J. R. Kaye, M.B., D.P.H.*

Metropolitan Asylums Board. Report on Return Cases of Scarlet Fever and Diphtheria notified for the three years 1902, 1903, and 1904 (with four Charts). By F. M. Turner, M.D. 25 pp., fcp. London, 1906.
The Board.

Mortimer, *J. D. E., M.B., F.R.C.S.,* and **Collie,** *R. J., M.D.* Nursing at Home. With Chapters on the Care of Infants and Children. 127 pp. London, 1906. *The Publishers (G. Gill & Sons, Ltd.).*

New South Wales. *Board of Health.* Report on Plague, 1905.—On a Fifth Outbreak of Plague at Sydney, 1905, by J. Ashburton Thompson, M.D., D.P.H., President; On Outbreaks of Plague on the Clarence and Richmond Rivers, 1905, by R. J. Millard, M.D., D.P.H.: On an Outbreak of Plague at Newcastle, 1905, by R. Dick, M.B., D.P.H. 80 pp., fcp. Sydney, 1906.
J. Ashburton Thompson, M.D., D.P.H.

Ontario. *Association of Architects.* Proceedings, Sixth Annual Volume, 1906. 99 pp., 8vo. Toronto, 1906. *The Association.*

——— *Provincial Board of Health.* The Sanitary Journal, being the Twenty-fourth Annual Report for the year 1905. 211 pp., 8vo. Toronto, 1906.

——— Report relating to the Registration of Births, Marriages, and Deaths in the Province of Ontario for the year ending 31st December, 1904. 258 pp., 8vo. Toronto, 1906.

Punjab. Report of the Sanitary Administration, and the Proceedings of the Sanitary Board for 1905. By Lt.-Col. C. J. Bamber, I.M.S., D.P.H. 20 pp. and Appendix, fcp. Lahore, 1906.

——— Notes on Vaccination in the Punjab for 1905—1906. 15 pp., fcp. Lahore, 1906. *Lt.-Col. C. J. Bamber, I.M.S., D.P.H.*

Southport. *Meteorological Department.* Report and Results of Observations for the Year 1905. By J. Baxendall, F.R.Met.Soc. 30 pp., 4to. Southport, 1906. *J. Baxendall, F.R.Met.Soc.*

Thresh, *J. C., M.D., D.Sc., F.I.C., and* **Porter,** *A. E., M.A., M.D.* Preservatives in Food and Food Examination. 456 pp., 8vo. London, 1906. *J. C. Thresh, M.D., D.Sc.*

United States of America. Geological Survey. A Review of the Laws forbidding Pollution of Inland Waters. Second Edition. By E. B. Goodall. 149 pp., 8vo. Washington, 1905. *W. Whitaker, B.A., F.R.S., F.G.S.*

——— Geological Survey. The Normal Distribution of Chlorine in the Natural Waters of New York and New Zealand, by D. D. Jackson. 28 pp., 8vo. Washington, 1905. *The Survey.*

——— Philadelphia: Hospital Reports. Vol. XI., 1905. 420 pp., 8vo. Philadelphia, 1906. *The Hospital.*

——— Report of the Commissioner of Education for the year ending June 30th, 1904. Vol. I. 1,176 pp., 8vo. Washington, 1906. *The Commissioner.*

——— Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and Subjects. Second Series, Vol. XI. Mo-Nyström. 858 pp., 4to. Washington, 1906. *The Surgeon-General.*

Vaccination. Pickings from Pro-vaccinist Polemics. 148 pp., 8vo. Stone, 1906. *The Publishers.*

Venice. *Commune di Venezia.* Case Sane Economiche e Popolaria. 40 pp. (Plates), 4to. Venice, 1906. *Filippo Grimani.*

In addition to the Books presented to the Library, the following have been published in connection with Sanitary Science:—

Belli, *Dr. C. M.* Naval Hygiene. 1 Vol., 8vo. Societa Editrice Libraria, of Milan.

Elkington, *Lt.-Col. H. P. G.* Notes on Military Sanitation. St. John's Ambulance Association, St. John's Gate, Clerkenwell, E.C.

Elliott, *M., LL.B.*, and **Elliott,** *G., M.R.C.S., D.P.H.* The Public Health Acts. 180 pp., 8vo. H. K. Lewis, London, 1906.

Glen, *A.*, **Jenkin,** *A. F.*, and **Glen,** *R. F.* The Law relating to Public Health and Local Government, Two Vols. Chas. Knight & Co., Ltd., London.

Harrison, *J. W.* Lessons on Sanitation. C. Griffin & Co., London.

Ishigami, *Dr. Tohiu.* A Text-book on Plague. 188 pp., 8vo. Vardon & Pritchard, Adelaide.

Lamb, *Capt. G., M.D., I.M.S.*, and **Pai,** *Assist.-Surg. M. Kesava, M.B., C.M.* Madras. Scientific Memoirs by Officers of the Medical and Sanitary Department of the Government of India: Isolation of the Micrococcus Melitensis. 22 pp., 4to. Office of the Superintendent of the Government Printing, Calcutta, India, 1906.

Middleton, *G. A. T.* Modern Buildings: their Planning, Construction, and Equipment. Vol. III. Caxton Publishing Co., Surrey Street, W.C., London.

Neumann, *Prof. L. E.* A Treatise on the Parasites and Parasitic Diseases of the Domesticated Animals. Translated by George Fleming, C.B. Baillière, Tindall, & Cox, London.

Parsons, *H. de B.* The Disposal of Municipal Refuse. J. Wiley & Sons, New York.

Sayers, *A.* Experiments on Hot-Water Systems. 168 pp., 8vo. Sanitary Publishing Co., London, 1906.

Sennett, *A. R.* Garden Cities in Theory and Practice. Vols. I. and II. 1,404 pp., 8vo. Bemrose & Sons, Ltd., London, 1905.

Stewart, *G. N., D.Sc., M.D.* A Manual of Physiology. Fifth Edition. 929 pp., 8vo.; 395 Illustrations. Baillière, Tindall, & Cox, London, 1906.

Weber, *Sir Hermann.* On Means for the Prolongation of Life. 104 pp., 8vo. J. Bale, Sons, & Danielsson, Ltd., London, 1906.

LIST OF EXHIBITS ADDED TO MUSEUM.

Combined Drain Testing Expansion Plug. Plug expands from $3\frac{3}{4}''$ to $5\frac{1}{4}''$, and with the addition of auxiliary rubber ring to $6\frac{3}{8}''$.

Combined Gradient Rule and Level for sighting levels, and for fixing work to various gradients. *Smith & Co., Walkley, Sheffield.*

Specimens of Tse-Tse Fly from Dodoira, Occia District, Gold Coast, West Africa. *C. H. Laing, Edinburgh.*

Locking Bricks for forming open walls for Bacteria Filters, etc. The bricks are securely bonded by dowels and recesses, and need no cement or mortar jointing. Easily removed for access. *J. Hines*, 20, *Victoria Street.*

Lead Water Pipe, with seamed joint longitudinally, and the old fashioned cup or ball joint with run lead. Removed from Middleton Castle, Yorks, and supposed to be 14th or 15th Century work.
J. T. Pegge, City Engineer, Durham.

Diagrams and Charts. Elementary Hygiene, etc., suitable for Schools, etc.
E. J. Arnold & Sons, Leeds.

Dry Earth System Closet. Simple in action; automatic supply.
George Bradley, Hampton Wick.

GENERAL NOTES.

A Medical Congress and International Exhibition of Hygiene is to be held at Montevideo from January 13th to March 13th, 1907. The Office of the Secretary General of the Congress is Palacio del Ateneo (Plaza Cagancha), Montevideo.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	122	14	0

Contributions since last Report.

		£	s.	d.
James L. Catterall	during five years	2	12	6
W. T. Toogood (2nd donation)			10	6

Oct. 24th, 1906.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

FIRE TESTS WITH FLOORS.*

This is the latest of the "Red Books" containing the Committee's report of a practical fire test carried out with all the care and thoroughness for which the Committee are noted, conducted in the presence of the interested parties and a large number of visitors. The area of the floor was 410 feet superficial, divided into three equal reinforced concrete bays, supported by two reinforced concrete beams with a span of 15 feet. The floor was 6 inches thick, and the beams projected 17 inches below the floor. The load was 280 lbs. per square foot. The small bars for reinforcing the general floor surface were 8 millimetres square ($\frac{1}{3}$ in.), and placed 3 inches centre to centre, with others crossing them and making a grid with meshes 15 inches by 3 inches. The centering was struck after 14 days, and 39 days (summer) were allowed in all for drying. The fire was of four hours' duration. At the expiration of 15 minutes, when a temperature of 760° Fahr. had been reached, the floor began to deflect, and continued to do so until the end of the test, when a deflection of 0·9 inches had been reached, with a temperature of 1,750° Fahr. A jet of water was then applied to the underside of the concrete, and the soffit of the beams, where struck by the jet, was knocked off, exposing the rods in the lower part of the beams. The soffit of the floor was also eroded where struck by the jet. On the load being removed, the surface of the floor showed various cracks. The permanent set of the floor over the beams was average $\frac{3}{4}$ in., and the permanent set of the bays between the beams was average $\frac{3}{4}$ in. Neither fire, smoke, nor water passed through the floor. Classification, fully protective (Class B), was obtained.

The recording Secretary appends the following notes:—

"The test reported in this publication does not add materially to the knowledge obtained from former tests of a similar character. It, however, emphasises the lessons taught by former experience, viz., that however carefully the rods are fixed, they get to some extent displaced while the concrete is being filled in. Some of the rods to the bays were found to be just under the soffit of the concrete, whereas they were supposed to be one inch from it. The result was that the bays were deflected in addition to the beams, in consequence of the weakening of the bars by reason of their becoming heated. The occasion of this report is taken to remark that, for floors tested in the future, it might be advisable to uniformly limit the area of the cross section of the beams employed in proportion to the span and load. Attention should in future be called to the factor of safety calculated."

It will be observed that this test was solely to discover the fire-resisting properties of the floor, and was independent of any question of economical construction, but it may be taken as a fair sample of the general construction of such floors, and their action under fire and water. H. A.

* Fire Tests with Floors: A Floor of Reinforced Concrete by the Patent Indented Steel Bar Co., Ltd., London. British Fire Prevention Committee. 2s. 6d.

MEETINGS HELD.

EXAMINATIONS.

The following Examinations have been held :—

Sanitary Science as applied to Buildings and Public Works.

November 9th and 10th, Newcastle-on-Tyne: 3 Candidates; no Certificates granted.

Inspectors of Nuisances.

September 28th and 29th, Bloemfontein: 8 Candidates; 6 Certificates granted.

November 9th and 10th, Newcastle-on-Tyne: 36 Candidates; 16 Certificates granted.

Inspectors of Meat and other Foods.

October 26th and 27th, Newcastle-on-Tyne: 10 Candidates: 3 Certificates granted.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES.

Inspectors of Nuisances.

BINKS, ANNIE.
BOAZ, FRANCIS EDWIN.
BROWNLESS, WILLIAM SCOTT.
BUSHELL, JOHN.
COLLIN, SAMUEL STOREY.
DIXON, GEORGE WILLIAM.
FENWICK, PETER.
FRIGERIO, JOHN.
HALL, PENDRIL BLAIR.
JENNINGS, FRANK THOMAS STEELE.
LORD, WILLIAM HENRY.
McIVER, ALEXANDER.
MARTIN, HENRY ROSE.
MILBURN, EDWARD ERNEST.
RAMSAY, JAMES JOLLY.
STANLEY, JAMES.
STUART, WILLIAM BURLTON.
TURNBULL, JOHN ROBERT.
WADE, GEORGE MATTHEW.
WRIGHT, ARCHIBALD GOODA.
YEOMAN, JAMES.
YOUNG, LAURA.

Inspectors of Meat and Other Foods.

HOWARD, AUGUSTINE D.
MOODY, HENRY FRED.
SAXTON, GEORGE ARTHUR.

FORTHCOMING MEETINGS.

SESSIONAL MEETINGS.

London, December 12th, 8 p.m.—Discussion on "The Advantages and Disadvantages of Heating Buildings by Gas Stoves of various types," to be introduced by S. Rideal, D.Sc.Lond., F.I.C.

The following places are proposed for meetings in 1907 :—Eastbourne, Plymouth, Glasgow, Stafford, Leeds, Lincoln, Hereford, Shrewsbury, Durham and Newcastle.

Examinations.

In Sanitary Science as applied to Buildings and Public Works,
Inspectors of Nuisances, and
In Hygiene in its Bearing on School Life—
London, December 7th and 8th.

Inspectors of Meat and Other Foods—
London, December 14th and 15th.

Conference at Dublin, 1907.

A Conference for the discussion of Sanitary and Public Health Questions has been arranged to be held in Dublin from June 25th to 29th, 1907.

Facilities will also be given to Delegates and Members to attend the Irish International Exhibition in Dublin, which will be in progress during the Conference.

Patron: His Excellency the Rt. Hon. the Earl of Aberdeen, Lord Lieutenant of Ireland.

President of the Conference:

Section I.—Sanitary Science and Preventive Medicine—
President: Sir Charles Cameron, C.B., M.D., D.P.H.

Section II.—Engineering and Architecture—
President: P. C. Cowan, B.Sc., M.Inst.C.E.

Section III.—Physics, Chemistry, Biology, and Meteorology—
President: Sir John W. Moore, M.D., D.Sc., F.R.C.P.I.

Hon. Secretaries: W. Kaye-Parry, M.Inst.C.E., F.R.I.B.A., M.A.
Surg.-Col. D. Edgar Flinn, D.P.H., F.R.C.S.I.

Calendar, December, 1906, and January, 1907.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee Finance Committee	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee New Premises Committee Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

DECEMBER.

1 S. **Sessional Meeting**, at 11 a.m. MALVERN. Discussion on "The Area for Sanitary Administration," to be opened by J. W. Willis Bund, M.A., Chairman of Worcestershire C.C. "Progress in Works of Public Health in Malvern, in recent years," by W. Osborne Thorp, Surveyor and Waterworks Engineer, Malvern U.D.C.

1 S. Demonstration on Meat Inspection to Commissioned Officers and Professional Men at Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.

6 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa, Chocolate, and Lime-juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

7 F. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

7 F. }
8 S. } Examination in Sanitary Science as applied to Building and Public Works, for Inspectors of Nuisances, and in Hygiene in its Bearing on School Life, London.

8 S. Demonstration on Meat Inspection to Commissioned Officers and Professional Men at Metropolitan Cattle Market, at 3 p.m., by James King, M.R.C.V.S.

10 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

11 T. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

12 W. Visit to Factory for Preparation of Concentrated and Preserved Foods.

12. W. **Sessional Meeting**, at 8 p.m., in the PARKES MUSEUM. Discussion on "The Advantages and Disadvantages of Heating Buildings by Gas Stoves of various types," to be introduced by S. Rideal, D.SC., F.I.C.

14 F. }
15 S. } Examination for Inspectors of Meat and other Foods, London.

25 T. } **Christmas Day** }
26 W. } **Bank Holiday** } Library and Museum closed.

JANUARY.

25 F. }
26 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its Bearing on School Life, Plymouth.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED,

NOVEMBER, 1906.

FELLOWS.

Marked thus have passed the Examination of the Institute for Local Surveyors.
‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

1071 1906. Nov. ADENEY, Walter Ernest, D.SC., *The Royal University, Dublin.*

1093 1906. Nov. ARCHIBALD, Edmund Douglas, M.A.OXON., *Constitutional Club, Northumberland Avenue, W.C.*

20 1906. Nov. †COOPER, Charles Hamlet, M.INST.C.E., *Borough Engineer, Wimbledon.*

22 1906. Nov. GLOYNE, Robert Maynard, M.INST.C.E., *Engineer's Office, London County Council, Spring Gardens.*

1023 1906. Nov. COOK, Jonathan Nield, D.P.H.CAMB., L.R.C.P.LOND., M.R.C.S.ENG., *Medical Officer of Health, Calcutta.*

2164 1906. Nov. DAVIES, David Samuel, M.D., D.P.H., M.R.C.S., *M.O.H.*, 40, *Prince Street, Bristol.*

1225 1906. Nov. DAVIES, Sidney, M.A., M.D.OXON., D.P.H.CAMB., *M.O.H., Town Hall, Maxey Road, Woolwich.*

1187 1906. Nov. EVANS, W. Arnold, M.D., D.P.H., *M.O.H., Town Hall, Bradford.*

39 1906. Nov. †‡MOSS-FLOWER, T. J., ASSOC.M.INST.C.E., F.G.S., *Victoria Mansions*, 28, *Victoria Street, Westminster, S.W.; and Carlton Chambers, Baldwin Street, Bristol.*

MEMBERS.

2169 1906. Nov. BAILIE, Hugh William, L.R.C.P., D.P.H., 45, *Ormau Road, Belfast.*

2170 1906. Nov. BLANEY, Charles, *Borough Surveyor, Newry, Co. Down, Ireland.*

2171 1906. Nov. BURKE, Arthur Ulick, 15, *Altona Terrace, North Circular Road, Dublin.*

2172 1906. Nov. COOK, John, A.M.INST.C.E., *City Engineer, City Hall, Cape Town, S. Africa.*

2173 1906. Nov. †COTTERELL, Albert Player Isaac, M.INST.C.E., F.S.I., 28, *Baldwin Street, Bristol.*

2174 1906. Nov. *M* GAIGER, Sydney Herbert, M.R.C.V.S., *Indian Civil Veterinary Dept., Lahore, Punjab, India.*

2175 1906. Nov. GULLAN, Hector Freeman, ASSOC.M.INST.C.E., *City Hall, Belfast.*

2176 1906. Nov. LOVIBOND, Joseph, F.R.M.S., *Luke, Salisbury, Wilts.*

2177 1906. Nov. GILL, William John O'Grady, "*Somerton*," 26, *Jasper Road, Upper Norwood, S.E.* (*Public Works Department, India.*)

2178 1906. Nov. GLEDHILL, George, *Engineer and Surveyor, Balby, near Doncaster.*

2179 1906. Nov. GREEN, George Arthur, *Public Works Dept., Bombay, India.*

2180 1906. Nov. LEDINGHAM, Alexander, M.A., M.D., D.P.H., *County Offices, Hamilton, Lanark, N.B.*

2181 1906. Nov. PHILLIPS, Robert Sebastian, *The Shire Hall, Gloucester.*

2182 1906. Nov. SORLEY, John, M.B., C.M., D.P.H., *Feilding, Province of Wellington, New Zealand.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

3984 1906. Nov. Houlton, Miss Sarah D., *Connaught House*, 136, *Elgin Avenue, Maida Vale.*

3985 1906. Nov. Ninkurji, Khelat Chunder, 9, *Lindsay Street, Calcutta, India.*

3986 1906. Nov. ‡Barnes, Fred, 45, *Grey Street, Burnley, Lancs.*

3987 1906. Nov. ‡Bass, William Henry, 12, *Little Heath Villas, Old Charlton, S.E.*

3988 1906. Nov. ‡Catherall, William, 9, *Crane Bank, Chester.*

3989 1906. Nov. ‡Collier, Miss Louise, 96, *Cotham Brow, Bristol.*

3990 1906. Nov. ‡Crownshaw, Miss Bertha, 56, *Laird Road, Wadsley, Sheffield.*

3991 1906. Nov. ‡Daniel, William, 14, *Highbury Grange, Islington, N.*

3992 1906. Nov. ‡Edwards, Albert E., 3, *New Market Row, Grand Parade, Bath.*

3993 1906. Nov. ‡Garnett, Ernest, 5, *Trenthem Place, Dewsbury Road, Leeds.*

3994 1906. Nov. ‡Hall, Bernard Cecil, *Newport Cottage, Newport, Lincoln.*

3995 1906. Nov. ‡Hickson, Thomas, 14, *Dierden Street, Winsford, Chester.*

3996 1906. Nov. S Holland, George Frederick, 28, *Boston Street, Sowerby New Road, Sowerby Bridge, Yorks.*

3997 1906. Nov. ‡James, Charles Thomas, 4, *Paxton Terrace, Barrow-in-Furness.*

3998 1906. Nov. ‡Keeley, Cecil John Harvey, "*Dromin,*" *Kirtleton Avenue, Weymouth.*

3999 1906. Nov. ‡Kennan, William, *Park Street, Barlborough, near Chesterfield.*

4000 1906. Nov. S‡Kidd, William, *Adelaide Terrace, Addingham, Leeds.*

4001 1906. Nov. ‡Lea, Walter, 33, *Stanley Street, Ormskirk.*

4002 1906. Nov. ‡MacBride, Miss Helena Steele, B.A., 1, *Alverton, Cliftonville Road, Belfast.*

4003 1906. Nov. ‡Nicholas, John Reginald Gordon, *Glenuce, Avenue Road, Doncaster.*

4004 1906. Nov. ‡Priest, Alfred, 238, *Brockley Road, Brockley, S.E.*

4005 1906. Nov. ‡Rouse, Francis James, 12, *White Horse Hill, Chislehurst.*

4006 1906. Nov. ‡Shelly, Samuel P., 26, *Egmont St., New Cross, S.E.*

4007 1906. Nov. ‡Silkstone, George Rowland, *Victoria Street, S. Normanton, Alfreton, Derbys.*

4008 1906. Nov. ‡Steen, Miss Kate, *Allandale, Haywood Road, Mapperley, Nottingham.*

4009 1906. Nov. ‡Walker, James, *Walham House, Glasgow Street, Northampton.*

4010 1906. Nov. ‡Ward, John Henry, 5, *Granville Terrace, Newport, Salop.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

London. *Civil and Mechanical Engineers' Society.* Transactions, Forty-seventh Session, 1905–06. pp., 8vo. London, 1906. *The Society.*

——— *Royal Institute of British Architects.* Calendar, 1906–07. 420 pp., 8vo. London, 1906. *The Institute.*

——— *University College.* Calendar, Session 1906–07. 433 pp., 8vo. London, 1906. *The College.*

Cross, *A. W. S., M.A., F.R.I.B.A.* Public Baths and Wash-houses: a Treatise on their Planning, Design, Arrangement, and Fitting, having special regard to the Acts arranging for their provision; with Chapters on Turkish, Russian, and other special Baths, Public Laundries; Engineering, Heating, Water Supply, etc. Price 21s. 276 pp., 4to. London, 1606. *B. T. Batsford (publisher).*

Garden City Association. Housing in Town and Country: being a Report of a Conference of the Garden City Association, held on March 16th, 1906. 70 pp., 8vo. London, 1906. *The Garden City Association.*

Hasluck, *P. N.* Sanitary Construction in Building. 160 pp., 8vo. London, 1906. *Cassell & Co., Ltd. (publishers).*

——— Sanitary Conveniences and Drainage. 160 pp., 8vo. London, 1906. *Cassell & Co., Ltd. (publishers).*

Herring-Shaw, *A., R.P.C.* Elementary Science applied to Sanitation and Plumbers' Work. 234 pp., 8vo. Altrincham, 1906. *The Sanitary Publishing Co.*

Local Government Board. Dr. E. P. Manby's Report upon the Sanitary Circumstances and Administration of the Windsor Rural District, with special reference to the need for a Drainage System in the Parishes of Sunninghill and Sunningdale. No. 241. 11 pp., fcp. London, 1906. *W. H. Power, C.B., F.R.S.*

London. Fire Tests with Floors: A Floor of Reinforced Concrete. The Committee's report. 24 pp., 8vo. London, 1906. *The Patent Indented Steel Bar Co., Ltd.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, September, 1906 .. .. *Prof. Matthew Hay, M.D.*
Lancaster, the County Palatine of, 1905 .. .. *E. Sergeant, M.R.C.S.Eng.*
Capetown, 1905–06 .. .. .. *A. Jasper Anderson, M.A., M.B., D.P.H,*
London, City of, Four weeks ending October 13th, 1906 .. .. *W. Collingridge, M.D., D.P.H.*
New Zealand, 1905 .. .. .. *J. Malcolm Mason, M.D., D.P.H.*
Staffordshire C.C., 1905 .. .. *George Reid, M.D., D.P.H.*
Toronto (City Engineer's), 1905 .. *C. H. Rust, C.E.*
Warwickshire C.C., 1905. .. .. *Prof. A. Bostock Hill, M.Sc., M.D., D.P.H.*

Metropolitan Water Board. Third Annual Report, for Year ended 31st March, 1906. 110 pp., 8vo. London, 1906. *The Clerk of the Board.*

Paris. *Préfecture du Département de la Seine.* Direction Administrative des Travaux de Paris. Notes à l'Appui du Compte des Dépenses de l'Exercice, 1905. 231 pp., 4to. Paris, 1906.

Registrar-General. Fiftieth Detailed Annual Report of the Births, Deaths, and Marriages in Scotland. (Abstracts of 1904.) 571 pp., 8vo. London, 1906. *The Registrar-General.*

Rivers Pollution. Report on a Visit to Germany, in August, 1906, by H. McLean Wilson and H. T. Calvert. 36 pp., 8vo. Wakefield, 1906. *H. McLean Wilson, M.D., B.Sc.*

LIST OF EXHIBITS ADDED TO MUSEUM.

An Educational Colour Set for demonstrating the colour composition of white light by the absorptive method, containing a stand to hold the glasses in position for demonstrating, with wings and top preventing lateral reflection, with 18 standard glasses in a sectional tray, and diagrammatic illustrations.

Smoke Density. Pocket Instrument for the use of Inspectors.

Tintometer. Instrument for giving a standard comparison of colours. *J. W. Lovibond, The Colour Laboratories, Salisbury.*

Drain Pipes, stoneware double-lined Archer joint. *The Archer Sanitary Tube Co., 64, Victoria Street.*

Dust-bin, galvanized iron, with a number of holes close under the top rim. *Croggan & Co., Ltd., 16, Upper Thames Street.*

Enamel. "Sanaline" Inner Doors of Entrance Corridor, prepared and painted. *Aspinall, Ltd., New Cross, S.E.*

Iron Drainage Pipes, with Access-cap concentric with interior of pipe, and having non-detachable fastenings. *J. Knight & Sons, 249, Gertrude St., King's Rd., Chelsea.*

Metal Mould, for casting and soldering tacks on to lead soil-pipes, etc., in one operation. *T. G. Chapman, 43, Grasmere Road, Woodside Street, Norwood.*

"**Toila,**" a sanitary paper cover for seats of W.C.'s. *Jules Lang & Co., St. Mary Axe, E.C.*

Ventilator. Inlet formed of iron frame and cream-glazed earthenware centre, the latter pierced with close openings bevelled on inner face. Fitted with hit-and miss shutter. *Comyn, Ching & Co., Lower St. Andrew St., W.C.*

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
AMOUNT ALLOTTED BY COUNCIL	9,000	0	0
CASH RECEIVED IN DONATIONS, ETC., 1899–1905 ...	1,167	11	6
PROMISES OF DONATIONS & SUBSCRIPTIONS, ALREADY REPORTED TO DEC. 31, 1905	1,048	4	0
PROMISES OF DONATIONS TO THE DOUGLAS GALTON GALLERY	110	10	0
CONTRIBUTIONS, 1906, ALREADY REPORTED	125	17	0

Contributions since last Report.

	£	s.	d.
D. PUGH-JONES ... ... (during two years)	2	2	0
G. R. STRACHAN ... ... (during five years)	10	10	0

November 27th, 1906.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

SYLLABUS OF PHYSICAL EXERCISES FOR USE IN THE BRISTOL EDUCATION COMMITTEE'S SCHOOLS.*

This handy little book of 69 pages contains directions for a large variety of exercises suitable for children of either sex, and of different ages and constitutions.

The marching exercises are of the usual semi-military character, but are well graduated to meet the varying requirements of different classes of children. The balance, postural, and corrective exercises are based upon the Swedish system, and are judiciously interspersed among others embodying simple automatic movements, but the accessory gymnastic appliances (*e.g.*, ribbed stools, booms, and climbing ropes) of the Swedish system are not here utilized. Directions are given to teachers, under "Signs of Good and Bad Health" respectively, for ascertaining whether children are, or are not, fit for the exercises prescribed, but it is surely better to insist that all children shall undergo a medical examination by way of test, than to leave the matter to the unaided judgment of the teacher.

P. B.

CONSUMPTION: ITS RELATION TO MAN AND HIS CIVILIZATION.†

This American work on Consumption can be skimmed with advantage even by physicians and medical officers of health; although it appears to be intended in the main for a wider public, and is in fact, in parts, "journalese." This appears to arise from the fact that many of the chapters of the book had previously appeared in various medical and popular journals. Had the author possessed a blue pencil, and used it until the book was reduced to half its present size; had he then rewritten part of the remainder, so as to avoid overlapping, and to secure a logical arrangement of his matter, the result would have been a more valuable book.

As it is at present, however, there is much useful information which may be read with advantage by all who wish to fight the white man's plague. Every aspect of the disease is considered more or less, sociological factors receiving a special prominence. The part describing American sanatoria is especially good; and some of the devices described for securing open-air treatment in city houses are most ingenious.

A. N.

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* Syllabus of Physical Exercises for use in the Bristol Education Committee's Schools, compiled by C. Percy Rea, Superintendent of Physical Instruction. 1906.

† Consumption: Its Relation to Man and His Civilization, Its Prevention and Cure, by J. B. Huber, M.A., M.D. Lippincott & Co., 1906, pp. 536, with 136 figures.

PUBLIC BATHS AND WASH-HOUSES.*

The author draws attention in his preface to the fact that "there is at present no really modern comprehensive volume" upon the design and construction of public baths, and the Reviewer may add that Mr. Cross has gone some way towards meeting this want.

Some practical papers upon the subject have been contributed to the Journals of The Royal Sanitary Institute, Royal Institute of British Architects, Architectural Association and elsewhere during the last ten years, and the author would have done well to have made some mention of these, or at least appended a short list. It is a very full subject crowded with details, and one which has not—since Roman times—been developed to the extent which its importance (from the hygienic point of view) demands.

So far as it goes, the author has with true wisdom given lavishly of his knowledge, and has not hesitated to give particulars and details which will be of material use to others of his profession in designing and building these institutions. The book is admirably illustrated by plans and other details of no less than twenty modern baths, and the examples chosen are of the best; although that is not to say that there are no better.

Very interesting are the floating baths designed by Messrs. Kaye, Parry, and Ross, of Dublin; and the sea baths at Warren Point, Ireland, by the same architects.

Mr. Cross's own baths at Haggerston and elsewhere are fully illustrated and detailed, and they reveal in the architect a good grasp of principles of planning, and much originality in detail.

So much cannot, however, be said for the very large portion of the book dealing with the question of engineering. The whole subject, including the specification, is rather obviously made up from the ideas and specifications of so-called *practical* engineers (*i.e.*, commercial firms), whose names are largely advertised therein.

Such engineering is good in its way—in some cases very good; but it cannot be compared for cost and efficiency with that designed by a qualified professional engineer; and the young architect will do well to take this portion of the book as giving a *general* idea only of bath engineering, and to seek the assistance of a professional engineer in this difficult subject for which his own education does not fit him.

There is a very interesting Chapter (XIII.) by Mr. E. J. Wakeling, M.A.B., upon the administration and cost of maintenance which contains many valuable suggestions.

Chapter XV. deals, rather superficially, with Turkish and other special baths, a subject which, by the way, is comprehensively dealt with by Mr. Owen Allsopp in another work.

Chapter XVI. gives some practical notes on the cost of construction. There are also some appendices dealing with Acts, By-laws, etc.

A. S.

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* Public Baths and Wash-houses: A Treatise on their Planning, Design, Arrangement, and Fitting, by Alfred W. S. Cross, M.A., F.R.I.B.A. B. T. Batsford, London, 1906.

MEETINGS HELD.

Sessional Meetings.

London.—The meeting was held in the Parkes Museum on Thursday, December 12th, at 8 p.m., when a discussion on "The Advantages and Disadvantages of Heating Buildings by Gas Stoves of Various Types" was introduced by S. Rideal, D.Sc.Lond., F.I.C. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C., Chairman of Council.

Examinations.

The following Examinations have been held :—

Sanitary Science as applied to Buildings and Public Works.

November 30th and December 1st: Manchester, 3 Candidates; 1 Certificate granted.

December 7th and 8th, London: 27 Candidates; 11 Certificates granted.

Inspectors of Nuisances.

October 26th and 27th, Cape Town: 6 Candidates; 3 Certificates granted.

November 30th and December 1st, Manchester: 57 Candidates; 16 Certificates granted.

December 7th and 8th, London: 97 Candidates; 55 Certificates granted.

Inspectors of Meat and other Foods.

December 14th and 15th, London: 31 Candidates; 17 Certificates.

Hygiene in its bearing on School Life.

November 30th and December 1st, Manchester: 4 Candidates; 1 Certificate granted.

December 7th and 8th, London: 12 Candidates; 5 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Ayling, John.
Bennett, Philip Sidney.
Fearns, Frederick James.
Gibbard, Ernest John.
Green, Sidney George.
Green, William.
Maunder, Norman.
Mould, George.
Peacock, John Luddington.
Pitre, Trimbak Janardan.
Stainton, William John.
Worssell, James Lloyd.

Inspectors of Nuisances.

Bailey, William.
Barham, Sidney John Harry.
Bassett, Henry William.
Bates, George Herbert.
Beaumont, John William.
Bentley, Harry.

Inspectors of Nuisances—Continued.

Bradford, Harry Colston.
Brown, Joshua Wright.
Buckley, James.
Bullen, William Edward.
Chapman, Herbert George.
Christian, John Christopher.
Cocks, Percy Gerald.
Crabb, Percival Charles James.
Cripps, Fanny.
Culmer, George Giles.
Cunningham, William Meldrum.
Deeks, George.
Denby, Frederick.
Dickinson, Albert.
Dinsdale, Thomas.
Eley, William Henry.
Elliott, Dorothy.
Farlam, George William.
Freeman, Leonard.
French, Francis Harold.
Gomm, Grace Evangeline.
Halliday, John.
Harding, Walter Ernest.
Harris, Arthur Edward.
Hayes, Robert Thomas.
Hill, Herbert Fox.
Holden, Arthur Thomas.
Hughes, Francis Edward.
Jolley, William.
Johnson, Ethel Gertrude Monica.
Jones, David John.
Kent, James Alfred Thomas.
Lawrence, Ernest H.
Lighbody, Thomas Henry.
Lynas, Richard Christopher.
Mallett, Benjamin Thomas.
Martin, Cyril.
Matthews, Robert Henry.
Michael, William.
Miller, Agnes Mabel.
Miller, Louisa Annie.
Newport, Reginald Chas. Noel.
Oram, Ebenezer George.
Ostle, Mary.
Owen, Joseph.
Painter, Thomas.
Panks, John Brandon.
Pearce, Harry Archibald.
Pearce, William.
Piggott, Arthur Edward.
Rampling, George Fred.
Rees, Griffith John.
Rogers, George.
Rooke, Harry Thomas.
Saunders, Percy.
Scott, William Henry.
Sharp, Harold Gibbon.
Snook, Harold Virtue.
Staples, Mary Elizabeth.
Stevens, Gladys Eleanor Gill.
Sutherland, George A.
Sutton, Mary.
Thompson, Benjamin Handley.
Thurston, Harold William.
Watts, Thomas Nathaniel Watts.
Webb, Joseph Thomas.
Wienholt, Jessie Clementina.
Wyld, James.

Inspectors of Meat and Other Foods.

Buckle, Herbert Stewart.
Cuckney, John.
Draper, William Homer.
Fisher, Henry Francis Thornhill.
Hill, Charles William.
Kelland, William Cottman.
Kett, Philip.
Kett, Philip Frederick.
Major, Richard.
Peverett, George.
Pigott, Grenville Edmond.
Rabbetts, Charles George.
Roberts, Herbert Keeling.
Robinson, Ernest Sherwood.
Scott, Philip Clement.
Smith, Richard.
Standen, Robert Hargrave Fraser.

Hygiene in its bearing on School Life.

Hodgson, Lilian.
Kanthack, Emilia Victoria.
Marshall, Kate.
Richardson, Mary.
Western, Emily Georgina.
Western, Mary Priscilla.

FORTHCOMING MEETINGS.

It is proposed to arrange for Provincial Sessional Meetings in 1907 as follows:—

Stafford, Saturday, February 16th. Discussion on "To what extent must Authorities Purify Sewage?" to be opened by George Reid, M D., D.P.H., County Medical Officer of Health, Staffordshire. Visit to Sewage Disposal Works.

March, Newcastle; April, Lancaster; May, Eastbourne; June, Hereford; September, Shrewsbury; October, Lincoln or King's Lynn; November, Glasgow; December, Leeds.

And London Sessional Meetings in March, April, and May.

EXAMINATIONS.

In Sanitary Science as applied to Buildings and Public Works,
Inspectors of Nuisances, and
In Hygiene in its Bearing on School Life—

Plymouth, January 25th and 26th.
Glasgow, February 8th and 9th.

LECTURES.

The 42nd Course of Lectures and Demonstrations for Sanitary Officers will commence on February 11th.

The Tenth Course of Practical Instruction in Meat Inspection will commence on March 15th.

The Special Course on Food and Meat Inspection, arranged for Army Officers and professional men, will commence on April 26th.

Course of Lectures on Hygiene in its bearing on School Life, for School Teachers, will commence on February 18th.

Course of Lectures on Sanitary Science as applied to Buildings and Public Works, will commence on February 27th.

CONFERENCE AT DUBLIN, 1907.

A Conference for the discussion of Sanitary and Public Health Questions has been arranged to be held in Dublin from June 25th to 29th, 1907.

Facilities will also be given to Delegates and Members to attend the Irish International Exhibition in Dublin, which will be in progress during the Conference.

Patron: His Excellency the Rt. Hon. the Earl of Aberdeen, Lord Lieutenant of Ireland.

Section I.—Sanitary Science and Preventive Medicine—
President: Sir Charles Cameron, C.B., M.D., D.P.H.

Section II.—Engineering and Architecture—
President: P. C. Cowan, B.Sc., M.Inst.C.E.

Section III.—Physics, Chemistry, Biology, and Meteorology—
President: Sir John W. Moore, M.D., D.Sc., F.R.C.P.I.

Hon. Secretaries: W. Kaye-Parry, M.Inst.C.E., F.R.I.B.A., M.A.
Surg.-Col. D. Edgar Flinn, D.P.H., F.R.C.S.I.

CALENDAR, JANUARY AND FEBRUARY, 1907.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Exhibition Committee . . Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee . . Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee . Finance Committee . . .	Wednesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Parliamentary Committee . . New Premises Committee . . Disinfectant Standardisation Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

The January Committee and Council Meetings have been postponed to a week later than the usual date.

JANUARY.

25 F. }
26 S. } Examinations in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and in Hygiene in its Bearing on School Life, Plymouth.

FEBRUARY.

8 F. }
9 S. } Examination in Sanitary Science as applied to Building and Public Works, for Inspectors of Nuisances, and in Hygiene in its Bearing on School Life, Glasgow.

11 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

13 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

15 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

16 S. **Sessional Meeting,** Stafford. Discussion on "To what extent must Authorities purify Sewage?" to be opened by George Reid, M.D., D.P.H., County Medical Officer of Health, Staffordshire. Visit to Sewage Disposal Works.

18 M. Demonstration in the Parkes Museum, at 6 p.m. Building Materials and Construction, by the Director, E. White Wallis, F.S.S.

18 M. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood.

18 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by G. Newman, M.D., D.P.H., F.R.S.E., M.O.H., Finsbury.

20 W. Demonstration in the Parkes Museum, at 6 p.m. Baths and Lavatories, by the Director, E. White Wallis, F.S.S.

20 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

20 W. Lecture to Sanitary Officers at 7 p.m, Duties of a Sanitary Inspector—General B: Indoor, by G. Newman, M.D., D.P.H., F.R.S.E.

20 W. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood.

22 F. Lecture to School Teachers, at 7 p m. "Physiology," by Prof. H. R. Kenwood.

22 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by G. Newman, M.D., D.P.H.

22 F. } Examinations in Sanitary Science as applied to Buildings and Public Works, for
23 S. } Inspectors of Nuisances, and in Hygiene in its bearing on School Life, Hull.

S. Inspection and Demonstration in the district of Tottenham at 2.30 p.m. Conducted by J. F. Butler-Hogan, M.D., M.O.H.

25 M. Lecture to Sanitary Officers at 7 p.m. Infectious Diseases, by Prof. A. Bostock Hill, M.D., M.SC.

26 T. Lecture to Sanitary Officers at 7 p.m. Methods of Disinfection, by Prof. A. Bostock Hill, M.D., M.SC.

27 W. Demonstration in the Parkes Museum at 6 p.m. Waste Preventers and Water Closets, by the Director, E. White Wallis, F.S.S.

27 W. Inspection and Visit to Common Lodging House, Kemble Street, Drury Lane, W.C., at 2.30 p.m.

27 W. Lecture to School Teachers at 7 p.m. "Food and Clothing," by Col. J. Lane Notter, M.A., M.D., R.A.M.C.

27 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.D., M.SC.

MARCH.

Annual Meeting of Associates.

APRIL.

24 W. **Ordinary General Meeting** at 4.30 p.m.

JUNE.

25 to 29. **Conference at Dublin.**

MEMBERS AND ASSOCIATES ELECTED,

DECEMBER, 1906.

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

2183 1906. Dec. BELL-JOHN, Harry, P.A.S.I., *Public Works Dept., Pretoria, Transvaal, S. Africa.*

2186 1906. Dec. COURT, William Harold Arthur, 1, *Beckingham Rd., Leicester.*

2184 1906. Dec. DICKSON, George A. H., F.R.I.B.A., *Rand Club, Johannesburg, S. Africa.*

2188 1906. Dec. HURTLEY, William Holdsworth, D.SC., B.SC., *Chemical Dept., St. Bartholomew's Hospital E.C.*

2189 1906. Dec. KIRK, Thomas, ASSOC.M.INST.C.E., *City Engineer, Ipswich, Queensland.*

2190 1906. Dec. LYNAM, F. J., ASSOC.M.INST.C.E., *County Surveyor, Omagh, Co. Tyrone, Ireland.*

2194 1906. Dec. *MOORE, Frederick William, *Sea View House, Haigh.*

2191 1906. Dec. NATHAM, Sidney Herbert, M.A., M.D., M.R.C.S., L.R.C.P., D.P.H., 50, *Harrington Gardens, S.W.*

2192 1906. Dec. ROBERTSON, Clement Albert, P.A.S.I., 116, *High Holborn, W.C.*

2193 1906. Dec. STORY, Philip Francis, *St. Ives, Penrhyn Road, Kingston-upon-Thames.*

2195 1906. Dec. *THORP, William Osborne, *Surveyor and Engineer, Malvern, Worcester.*

2185 1906. Dec. TYRWHITT, Thomas, A.R.I.B.A., *Public Works Dept., Pretoria, Transvaal, S. Africa.*

2187 1906. Dec. WIGG, Willis, ASSOC.M.INST.C.E., 1, *Evesham Road, Narborough Road, Leicester.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

4011 1906. Dec. ‡Allsop, Fred., 56, *Lumn Street, Hyde, Cheshire.*
4012 1906. Dec. ‡Boaz, Francis Edwin, 6, *Waverley Villas, Hale, Cheshire.*
4013 1906. Dec. ‡Brownless, William Scott, *Asst. Surveyor, Sedgefield, Ferry Hill, Co. Durham.*
4014 1906. Dec. ‡Bushell, John, 33, *Trafalgar Street, Thornaby-on-Tees, Yorks.*
4015 1906. Dec. ‡Du Sautoy, Miss C. C., 16, *Elm Grove, Taunton.*
4016 1906. Dec. ‡Fenwick, Peter, 85, *Wayman Street, Monkwearmouth, Sunderland.*
4017 1906. Dec. ‡Frigerio, John I., 93, *Welbeck Road East, Walker, Newcastle.*
4024 1894. Feb. ‡Knappett, Benjamin A., *Sanitary Inspector, Town Hall, Catford, S.E.*
4018 1906. Dec. ‡Labard, Samuel, 12, *Great Ormond Street, Holborn, W.C.*
4019 1906. Dec. ‡Stanley, James, 41, *Stormont Street, North Shields.*
4020 1906. Dec. ‡Stuart, William Burlton, 32, *Castellain Mansions, Maida Vale, W.*
4021 1906. Dec. ‡Worden, Miss Jane, 133, *Mornington Road, Bolton, Lancs.*
4022 1906. Dec. ‡Wright, Archibald Gooda, 10, *Wroughton Road, Wandsworth Common, S.W.*
4023 1906. Dec. ‡Young, Mrs. Laura, 35, *Ayresome Street, Middlesbro', Yorks.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMY (British).

London. *City of London College.* Calendar, 1906–07. 209 pp., 8vo. London, 1906. *The College.*

Board of Agriculture and Fisheries. Leaflets: Section 1, Acts of Parliament, Co-operation, and Miscellaneous Subjects; 2, Farm Animals, their Breeding and Management; 3, Poultry and Bees, their Breeding and Management; 4, Farm and Garden Crops; 5, Wild Animals, Birds, &c.; 6, Insects injurious to Crops other than Bush and Orchard Fruit; 7, Insects injurious to Fruit Trees and Bushes, and to Forest Trees; 8, Fungi injurious to Crops and Fruit. 8vo. London, 1906. *Purchased.*

Greenwich Royal Observatory. Reduction of Greenwich Meteorological Observations. Part IV. Temperature of the Air as determined from the Observations and Records of the Fifteen Years, 1891–1905. 67 pp., 4to. London, 1906. *Sir W. H. M. Christie, K.C.B., M.A., F.R.S., Astronomer-Royal.*

Hamburg. Bericht des Medizinabrates über die Medizinische Statistik des Hamburgischen Staates für das Jahr 1905. Mit 5 Abbildungen im Text und 9 Tafeln. 93 pp. (Plates), 4to. Hamburg, 1906. *Prof. Dr. Nocht.*

Infantile Mortality. Report of the Proceedings of the National Conference on Infantile Mortality, London, June, 1906, by E. M. Smith, M.D., D.P.H., Medical Officer of Health, and Delegate of the York Corporation. 40 pp., 8vo. York, 1906. *E. M. Smith, M.D., D.P.H.*

Local Government Board. Dr. W. W. E. Fletcher's Report upon the Sanitary Circumstances and Administration of the Village of Coggeshall in the Braintree Rural District, and alleged prevalence therein of Infectious Disease; also, incidentally, upon Sanitary Administration in the Braintree Rural District. No. 244. 15 pp., fcp. London, 1906.

——— Dr. W. W. E. Fletcher's Report upon the Sanitary Circumstances and Administration of the Southwick-on-Wear Urban District, and upon recent prevalence of Zymotic Disease in the District. No. 245. 13 pp., fcp. London, 1906. *W. H. Power, C.B., F.R.S.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, October, 1906 .. .. *Prof. Matthew Hay, M.D.*
Leeds, 1905–06 .. .. .. *J. Spottiswoode Cameron, M.D., B.Sc.*
London, City of, Five weeks ending November 17th, 1906 .. .. *W. Collingridge, M.D., D.P.H.*

Porter, *Chas., M.D., B.Sc., M.R.C.P.Edin.* School Hygiene and Laws of Health: A Text-book for Teachers and Students in Training. 306 pp., 8vo. London, 1906. *Longmans, Green & Co. (publishers).*

Reid, *George, M.D., D.P.H.* Practical Sanitation: A Handbook for Sanitary Inspectors and others interested in Sanitation; with Appendix on Sanitary Law, by H. Manley, M.A., M.B., D.P.H. Thirteenth Edition. 337 pp., 8vo. London, 1906. *The Author.*

In addition to the Books presented to the Library, the following have been published in connection with Sanitary Science:—

Bardswell, *N. D., M.D.* The Consumptive Working Man: What can be done for him? London: Scientific Press, Ltd.

Critchley, *H. D., M.D.* Hygiene in School.

Crowe, *H. Warren, M.D.* Consumption: Treatment at Home and Rules for Living. Fcp. 8vo., 30 pp. Bristol: J. Wright & Co. 1906.

Fowlers' Architects' and Builders' Handbook. A Synopsis of Practical Rules, Tables, and Data specially compiled for the use of Architects, Builders, Plumbers, Painters, Decorators and Students in Technical Schools. 526 pp. Scientific Publishing Co., Manchester.

Giffen, *G. Haxton.* Students' Manual of Medical Jurisprudence and Public Health. Second Edition. 372 pp. Edinburgh: Wm. Bryce. London: Simpkin Marshall. 1906.

Greenwood, *A., M.B., Ch.B.* Infection: The Prevention of Infection in Public Vehicles. Sanitary Publishing Co., 5, Fetter Lane, E.C.

Howell, *W. H., Ph.D., M.D., LL.D.* Textbook of Physiology. Demy 8vo., 905 pp. 272 Illustrations. London: W. B. Saunders & Co. 1906.

Kelly, *Howard A.* Walter Reed and Yellow Fever. 293 pp. New York: McClure, Phillips, & Co. 1906.

Middleton, *G. A. T.* Modern Buildings, New Planning, Construction, and Equipment. Vol. IV. Caxton Publishing Co.

Prout, *W. T., C.M.G., M.D.* Lessons on Elementary Hygiene and Sanitation, with special reference to the Tropics. 159 pp. London: Waterlow & Sons. 1905.

Stephens, *F. E. R.* Digest of Public Health Case-Law. Demy 8vo., 664 pp. The Sanitary Publishing Co.

Thatcher, *J. Wells.* The Students' Handbook of Local Government Law. London: Chas. Taylor.

THE FOLLOWING JOURNALS AND PERIODICALS HAVE BEEN RECEIVED IN THE LIBRARY DURING 1906.

WEEKLY.

British Architect.
British Medical Journal.
Builder.
Builders' Journal and Architectural Record.
Contract Journal.
Domestic Engineering.
Engineering.
Hardware Trades Journal, The.
Health.
Indian Engineering.
Journal d'Hygiène.
Journal of the Society of Arts.
Lancet.
Local Government Chronicle.
Local Government Journal.
Local Government Officer.
London County Council Gazette.
Municipal Journal.
British Journal of Nursing.
Sanitarisch-demographisches Wochenbulletin der Schweiz.
Sanitary Record.
Surveyor and Municipal and County Engineer.
Universal Provider.
Veterinary Record.

MONTHLY, Etc.

Annales des Ponts et Chaussées.
Architect's Magazine.
British Journal of Inebriety.
Bulletin du service de Santé et de l'Hygiène publique (Bruxelles).
Bulletin de la Société des Ingénieurs et Architectes Sanitaires de France.
Canadian Nurse.
Chicago Health Bulletin.
Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege.
Direzione Generale dell' Amministrazione Civile. Bollettino Sanitario.
Engineering Magazine.
Giornale della Reale Società Italiana d'Igiene.
Glasgow Medical Journal.
Iowa Health Bulletin.
Journal of Hygiene.
Journal of the American Public Health Association.
Journal of the Royal Institute of British Architects.
Journal of the Royal Meteorological Society.
Journal of the Royal Statistical Society.
Journal of the Sanitary Inspectors' Association.
Journal of Preventive Medicine.
La Ingenieria.
La Salute Pubblica (Perugia).
La Technologie Sanitaire.
Le Génie Sanitaire.
Le Mois scientifique et industriel.
Medical Magazine.
Medical Temperance Review.
Meteorological Record.

Museums Journal, The.
New York State Board of Health, Monthly Bulletin.
North of England Institute of Mining Engineers' Transactions.
Plumber and Decorator.
Proceedings of the Society for the Study of Inebriety.
Public Health.
Registrar-General's Returns: England and Wales, Scotland, and Ireland. Weekly, Monthly, and Quarterly.
Revue d'Hygiène et de Police Sanitaire.
Sei-i-Kwai Medical Journal.
Société d'Hygiène de l'Enfance Bulletin Mensuel.
Surveyors' Institution, Transactions of.
Symons's Meteorological Magazine.
Tablettes Mensuelles de la Société Royale de Médecine publique.
Technology Quarterly and Proceedings of the Society of Arts (Massachusetts).
Tuberculosis.
Water.

LIST OF EXHIBITS ADDED TO MUSEUM.

Connections for W.C. Flush-pipe and Basin, "Sunflower" pattern, Cone of copper.
Flushing Cistern Chains, of copper, various types and handles.
Sunflower Closet Cone Co., Halifax.

"**Wirebitu**" **Damp-proof Sheeting,** prepared on meshed wire, suitable for roof covering, vertical or horizontal damp-proof courses, lining tanks; various models showing its application. *Vickers & Fields, 6, Eldon Street, E.C.*

Piece of Lead Waste-pipe from bath, showing damage caused by rats; space about two inches diameter gnawed through. *W. F. Foster, Balham.*

Piece of English Oak 500 years old, removed from Wittingham Church, Cambs. *O. Thomas, Sculptor, 9, College St., N.W.*

Glass-lined Gully Trap with sealed top, for use inside buildings or where an open gully is undesirable; ventilation is supplied by a side inlet. *John Knight & Son, Chelsea.*

Fixing for Soil, ventilation, and other lead pipes, with special cast-iron sockets.
Socket for base of soil pipe with flanged connection to fix in drain pipe socket.
Lead branch connection to iron soil pipe, fitted with coupling and brass sleeve piece.
Socket for vertical and horizontal waste pipes, with expansion arrangement for hot water from baths, lavatories, etc.
Jones & Roberts, 9, Bishop's Road, Paddington.

EXHIBITION AT BRISTOL, 1906.

LIST OF ADDITIONAL AWARDS FOR EXHIBITS SELECTED FOR FURTHER TRIAL.

BRONZE MEDALS.

Birch Killon & Co.
Fiddian's Rotary Distributor.

British Fuel Economiser and Smoke Preventer.
Bunsen Bridge for Boiler Furnacec.

PARKES MUSEUM NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1905 ...	1,167	11	6
Promises of Donations & Subscriptions, already reported to Dec. 31, 1905	1,048	4	0
Promises of Donations to the Douglas Galton Gallery	110	10	0
Contributions, 1906, already Reported	138	9	0

Contributions since last Report.

		£	s.	d.
F. J. Paris...	(third donation)		5	0
G. H. Widger	(during ten years)	5	5	0

December 19th, 1906.

COLONIAL NOTES.

Members in New Zealand will be interested to hear that a Board of Examiners has recently been established by The Royal Sanitary Institute in New Zealand, for the purpose of conducting Examinations for Sanitary Officers on the same lines as those held by the Institute in England and other colonies. The following members have expressed their willingness to act, and the Hon. Local Secretary is Dr. T. H. A. Valintine.

Sir Robert Stout, K.C.M.G., *Chief Justice, New Zealand.*
J. M. Mason, M.D., L.R.C.P., L.R.C.S., L.F.P.S., L.M., D.P.H., *Chief Health Officer for New Zealand.*
T. H. A. Valintine, M.R.C.S., L.R.C.P., D.P.H., *Assistant Chief Health Office, Wellington, New Zealand.*
R. H. Makgill, M.D., D.P.H., *Government Bacteriologist, New Zealand.*
F. Ogston, M.D., *District Health Officer, Otago, and Southland, N.Z.*
J. P. Frengley, M.D., D.P.H., *District Health Officer, Auckland, N.Z.*
F. I. de Lisle, L.R.C.P., D.P.H., J.P., *District Health Officer, Hawkes Bay, N.Z.*
A. Atkins, F.R.I.B.A., ASSOC.M.INST.C.E., *Wanganui, New Zealand.*
F. W. Marchant, M.INST.C.E., *Timaru, New Zealand.*
Hurst Seager, F.R.I.B.A., *Christchurch, New Zealand.*

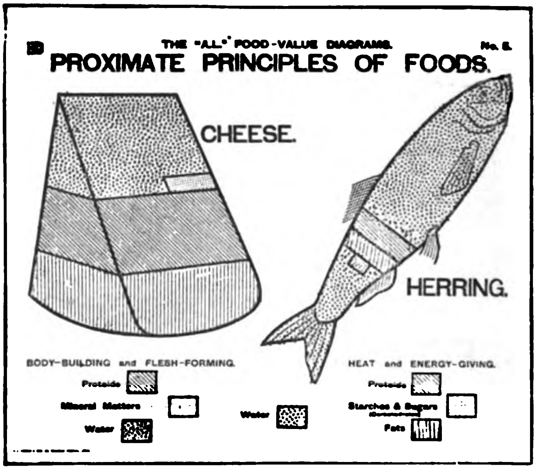
EXHIBITS FOR WHICH MEDALS HAVE BEEN AWARDED AT THE BRISTOL EXHIBITION, 1906.

EXHIBITS FOR WHICH MEDALS HAVE BEEN AWARDED AT THE BRISTOL EXHIBITION, 1906.

Food-Value Diagrams.

Bronze Medal.

To E. J. Arnold & Sons.



A set of six large charts, boldly drawn and coloured, and showing, either in tabular form or diagrammatically, the proximate principles contained in some typical articles of food. By a system of colouring and shading, heat- and energy-giving materials (starches and sugars) are distinguished from body-building and flesh-forming materials (proteids), and their relative proportions shown in the various articles of food illustrated. Animal proteids are also distinguished from vegetable proteids.

Each chart 42 in. × 33 in.

Price.—Each chart mounted on calico, with rollers and varnished, net 3/6. The set of six, net 18/-. The six charts on manilla, mounted under one top-lath, net 12/-.

Manufactured by E. J. Arnold & Son, Ltd., Educational Publishers, Leeds.

Steam Oven for Bakeries.

Bronze Medal.

To T. Collins & Co.

A double-decker baker and confectioner's oven, heated by one fire.

Various sizes.

Manufactured by Thomas Collins & Co., Three Queens Lane, Bristol.

Jacobs' Safety Mail Cart.

Bronze Medal.

To Monat & Co., Ltd.

The mail-cart is fitted with a brake which automatically stops the cart directly the attendant's hands are released from the handles, and frees the wheels when the handles are grasped to propel the cart.

Manufactured by Monat & Co., Ltd., 8, St. Paul Street, St. Pauls, Bristol.

Padded Room Fittings.

Silver Medal.

To Pocock Bros.

The fittings are made of non-absorbent material; with watertight joints, aluminium gutter, and with a special quadrant hinge which prevents the patient's fingers being smashed in the door.

Size.—12 ft. × 7 ft.

Price.—About £100 per room.

Manufactured by Pocock Bros., 235, Southwark Bridge Road, S.E.

Motor Ambulance.

Bronze Medal.

To Wilson & Stockall.

This ambulance will convey at one time two injured persons in a recumbent position on stretchers. It has seats provided for nurses or attendants. The ambulances can be supplied separately without the chassis. The interior can be specially arranged and fitted for conveying persons suffering from infectious diseases for isolation hospitals.

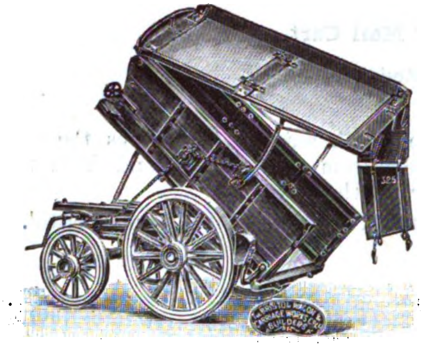
Prices.—£450 upwards, according to horse-power, number of cylinders, &c.

Manufactured by Wilson & Stockall, Ambulance Works, Bury.

House Refuse Covered tipping Van.

Bronze Medal.

To The Bristol Wagon and Carriage Works Co., Ltd.



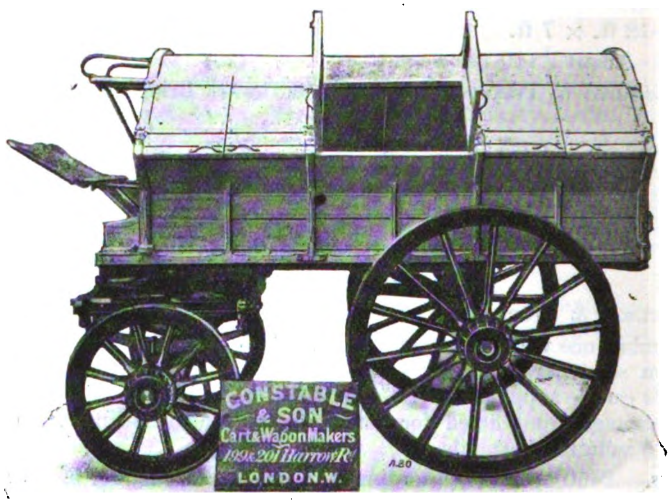
This is a strongly-made wagon with oak and ash frame, fitted with the patent screw tip, body made with solid sides, on springs, grease axles, and fitted with automatic covers, the working of which will easily be understood from the illustrations; when the wagon is tipped the covers rise automatically and quite clear of the load, so that there is no obstacle to the load being quickly and effectually discharged.

Manufactured by The Bristol Wagon & Carriage Works Co., Ltd., Bristol.

House Refuse Covered tipping Van.

Bronze Medal.

To Constable & Son.



The lids when open are held in an upright position by patent fastener, and form a perfect wind guard. By altering balancing point the van tips without any strain to body.

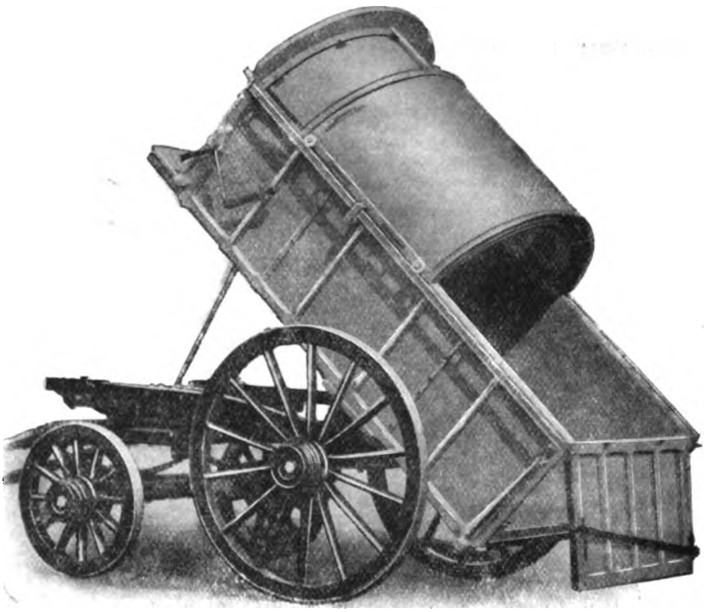
Sizes to suit requirements.

Manufactured by Constable & Son, Ltd., Harrow Road, W.

House Refuse Covered tipping Van.

Silver Medal.

To Wm. Glover & Sons, Ltd.



This cover is made without any hinges or levers, and the sheets are fitted with renewable brackets which allow the sheets to slide either transversely or lengthways, the latter leaving the back half of the van entirely free for emptying and preventing any possibility of damage to the back of the cover when tipping into a destructor.

Sizes.—1½ to 5 cubic yards.

Various prices.

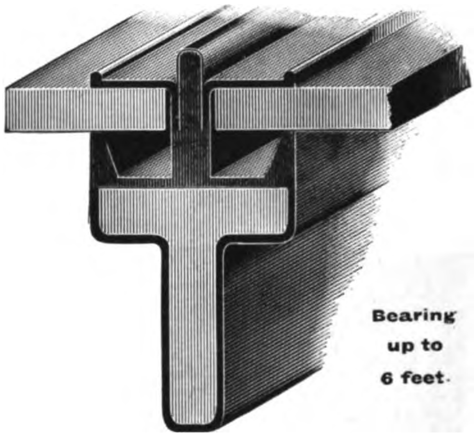
Manufactured by Wm. Glover & Sons, Ltd., Eagle Works, Warwick.

British Challenge Glazing Bars.

Bronze Medal.

To The British Challenge Glazing Co., Ltd.

Section H.—Bar 1×1¼×¼ in.



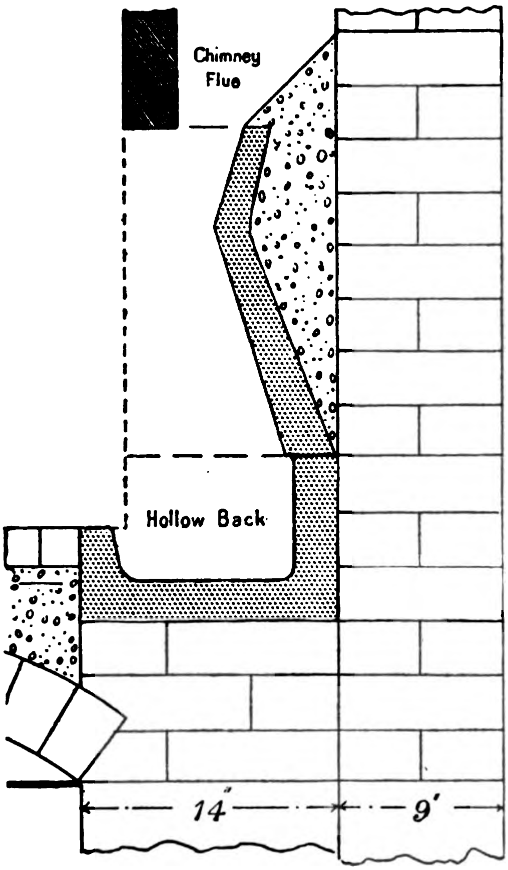
The T-steel forming core is completely clothed with seamless lead, and therefore no painting is required. The glass resting on cushions of pure lead, and being held in position by wings of same metal, due provision is made for expansion and contraction and the risk of breakages is reduced.

Manufactured by The British Challenge Glazing Co., Ltd., Bank Chambers, Tooley Street, E.C.

Glazed Faience "Devon" Fireplaces.

Bronze Medal.

To Candy & Co., Ltd.



Constructed with solid fireclay at the bottom, at the back, and both sides.

Size of fire opening from 12 in. to 21 in., suitable for any size opening of mantel.

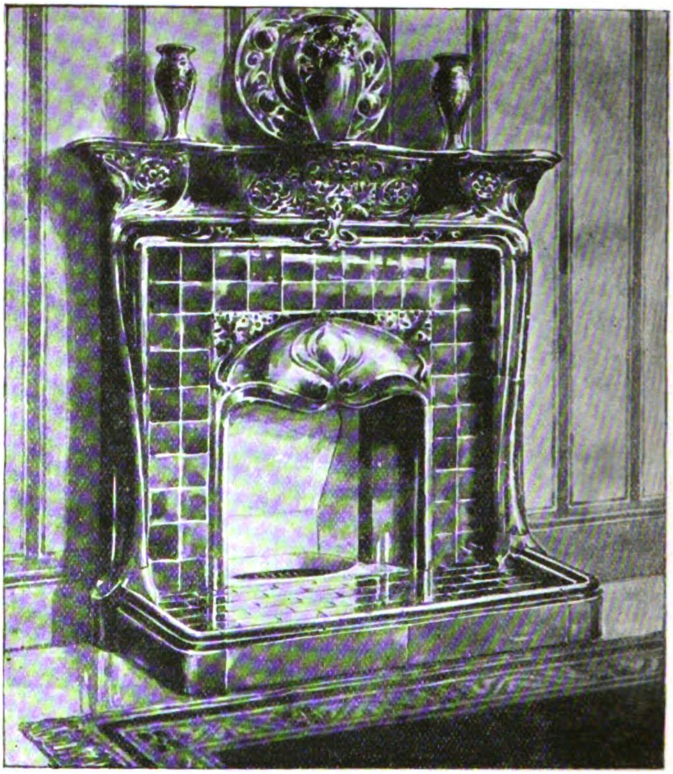
Prices from £2.

Manufactured by Candy & Co., Ltd., Newton Abbot.

Glazed Fireclay Fireplaces.

Bronze Medal.

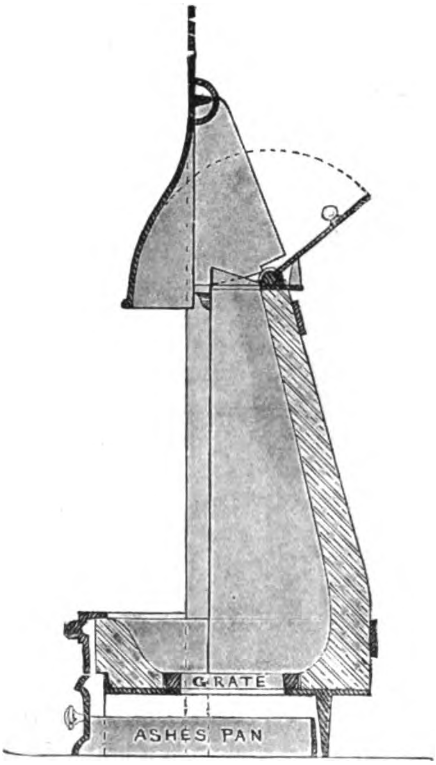
To DOULTON & CO., LTD.



This grate is a development along the lines of the "hearth" fireplaces. To remedy the objection of ash working forward on the hearth, a pit has been provided and covered with a movable grid, so that the advantages of "hearth" fires are maintained without some of the drawbacks. The exhibit included the form of fire and the complete mantel and fireplace, which is of fireclay and glazed.

PRICE.—Glazed fireplace and mantel, £10 5s. 6d.
Fender and hearth, £1 14s. 6d.

Manufactured by DOULTON & CO., Lambeth.



"Drawwell" Register Grate.

Bronze Medal.

To The Iron Marble Co., Ltd.,
33, Victoria Street, Bristol.

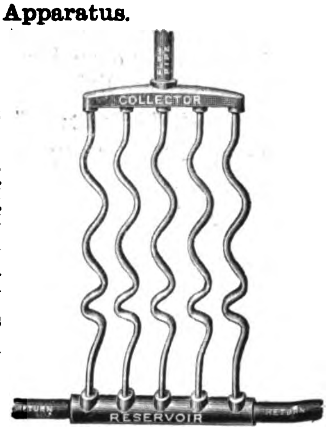
This grate is fitted with an adjustable canopy, semi-circular and solid brick back, sloping inwards, the bottom forming a dish or basin with loose grate to lift out. There is a ventilating fret with pan attached. When the fire is out the bottom grate can be removed.

Sizes.—Interiors, 21 in. by 38 in. Tile stoves, 36 in., 38 in. and 40 in. wide, by 38 in. high.

Combined Grate and Heating Apparatus.

Bronze Medal.

To J. D. Prior.



The heat distributor is a tubular boiler fixed at the back of the fire and opening of the chimney. It is connected by means of pipes with radiators fixed in bedrooms, halls, etc., or such other parts of the house as may require to be warmed. Made of stout solid-drawn copper tube of a flattened section and corrugated, its high conducting power and large heating surface causes it to absorb heat very rapidly. The water with which the apparatus is filled then circulates from the distributor, through the pipes to the radiators and back again.

4-tube Distributor, £3 5s.; 5-tube, £3 15s.

Manufactured by James D. Prior, Empire Works, Holliday St., Birmingham.

Venetian Fire Grate with Pivoted Bars.

Bronze Medal.

To J. D. Prior.

The front fire bars are hinged at the ends, and open and close like a venetian blind; by opening these bars air is admitted to the grate and a bright fire is obtained, and by closing them the air is excluded and the fire simply smoulders. In place of the usual ash-pan front are two draught doors, accurately fitted: by opening these doors the air is admitted underneath the fuel, promoting a rapid fire, whilst by closing them the air is excluded, and a slow fire is the result. The venetian bars are mounted in a frame hinged on to the side of the grate front, and swing open like a gate for easy cleaning. The draught regulator at the top of the fire linings controls the draught of the chimney.

Sizes.—21″ broad × 30″ high and 21″ broad × 38″ high.

Price.—From £2 17s. to £4 12s. 6d.

Manufactured by James D. Prior, Empire Works, Holliday St., Birmingham.

General Excellence of Door and Window Furniture.

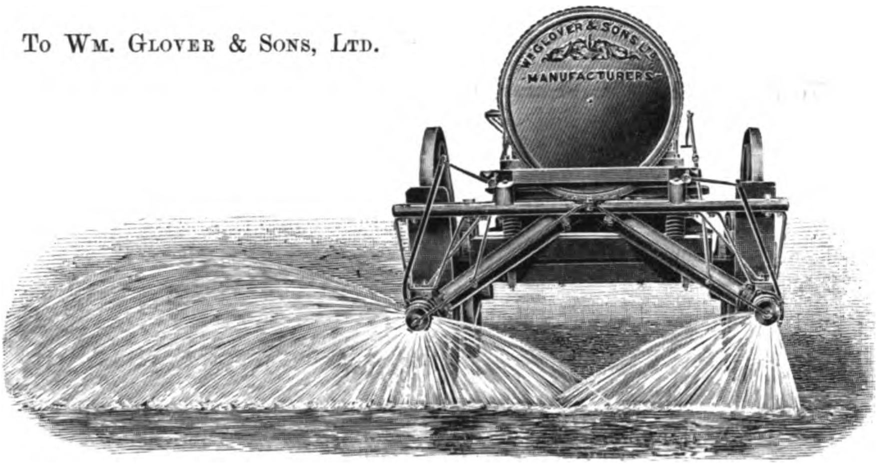
Bronze Medal.

To W. & R. Leggott, Ltd., Silens Works, Bradford.

"Warwick" Road Sprinkler and Flusher.

Silver Medal.

To Wm. Glover & Sons, Ltd.



The chief points of this van are the variation in the widths and the grade of spread, with the addition of a 4 in. flusher for filling up gulleys, &c. It is possible to give the very finest spray from 3 ft. wide up to a very heavy spray sufficient for road washing to 21 ft. wide, with any intermediate variation; all this and the flushing arrangement is worked from the driver's seat by 2 valves only.

Made in all sizes, 2 and 4 wheel, 150 gallons to 500 gallons.

Various prices.

Manufactured by Wm. Glover & Sons, Ltd., Eagle Works, Warwick.

Refuse Destructor with Centrifugal Dust Catcher.

Silver Medal.

To The Horsfall Destructor Co., Ltd.

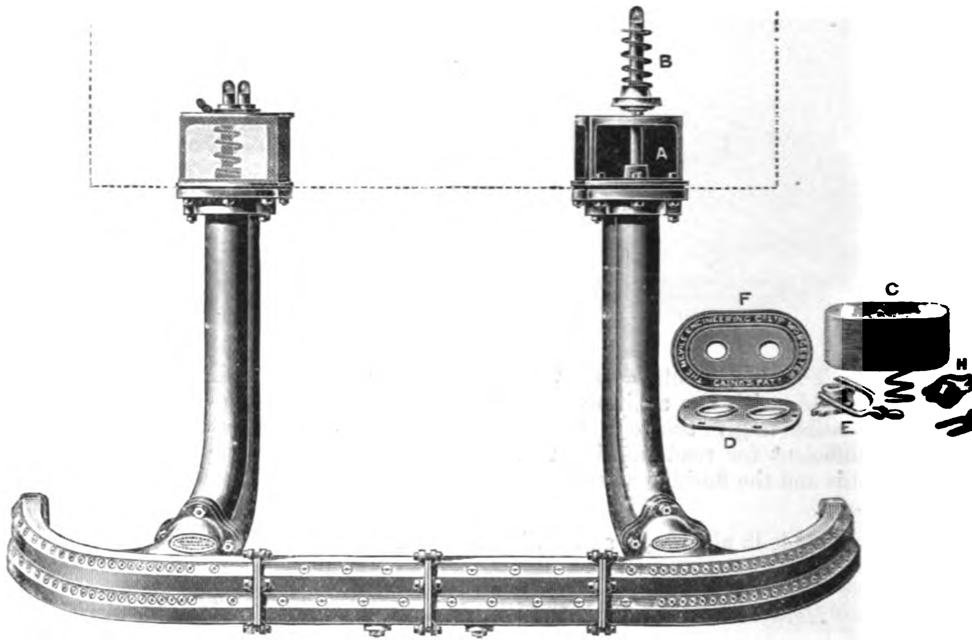
The Dustcatcher consists of an outer annular chamber and an inner well. The gases enter the outer chamber and swirl rapidly round it, thereby throwing off the suspended dust against the outer wall. The exit from the annular chamber is in the upper part, leading into the inner chamber or well. Here the gases have to pass downwards, and an outlet is provided near the bottom leading to the chimney. Cleaning doors are provided for removing the dust, which accumulates in the pockets formed at the bottom of each chamber. The dust can be cleared out of the pockets without in any way interfering with the working of the plant. This dustcatcher can be added to existing destructors of any make.

Manufactured by The Horsfall Destructor Co., Ltd., Lord Street Works, Whitehall Road, Leeds.

Caink's Jets and Sprinklers for Watering Van.

Bronze Medal.

To The Nevile Engineering Co., Ltd.



The jets give a uniform distribution of water on the road and at the same time split up the water with a spray. The jets are removable, and are manufactured in eight different sizes. Adjustment can be made to lay down exactly the quantity of water desired.

Sizes.—Double row of jets, giving three degrees of spray; single row of jets, in which spray can be altered by changing the jets.

Prices.—With double row of jets, complete, £15; with single do., £9 10s.

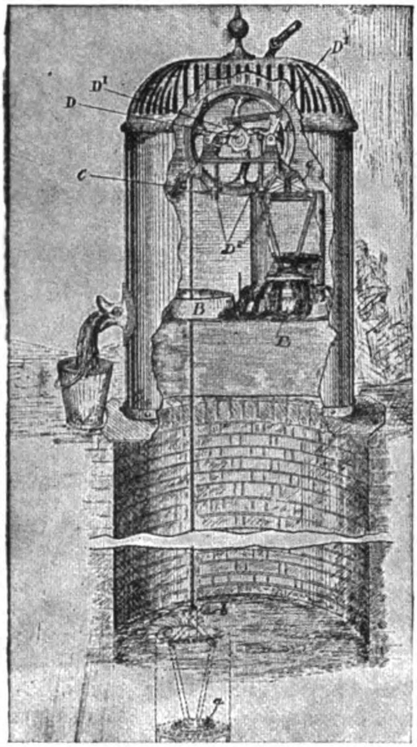
Other parts can be supplied separately.

Manufactured by The Nevile Engineering Co., Ltd., St. Martin's Gate, Worcester.

Safety Water Elevator Well Gear.

Bronze Medal.

To The Safety Water Elevator Co.



The appliance consists of a casing placed on the top of a well, in which a sprocket wheel, driven by a crank handle outside, is placed. A wire rope, supporting buckets fitted with valves in the bottom, runs over the sprocket wheel. When a bucket arrives at the top of its travel the valve is opened automatically, and the water runs into a channel leading to a spout fixed on the outside of the casing. A ratchet is fitted to prevent the buckets running down should the handle be released. These ratchets are automatically changed as each bucket arrives at the top, and the handle has to be turned in the reverse direction. This well gear will raise water from any depth.

Sizes.—Six sizes, 2 to 8 gallon buckets.

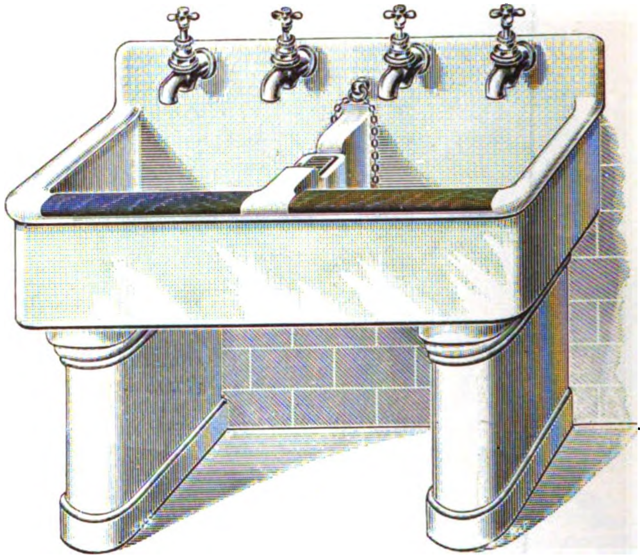
Prices.—From £7 10s. to £17.

Manufactured by The Safety Water Elevator Co., Dunstable, Beds.

Glazed Fireclay Ware Twin-Sink, with Central Overflow.

Bronze Medal.

To W. Harriman & Co., Ltd.



Made in white leadless glazed fireclay-ware, with high back, inserted wood protecting rims and glazed floor supports.

Sizes.—15 in. by 18 in. to 21 in. by 18 in.

Prices.—Cane glazed outside, 54s. to 74s. White glazed, 64s. to 84s.

With supports and accessories complete, cane glazed, 113s. to 133s.; white glazed, 128s. to 148s.

Manufactured by William Harriman & Co., Ltd., Newcastle-upon Tyne.

Non-crazing Semi-porcelain Ware.

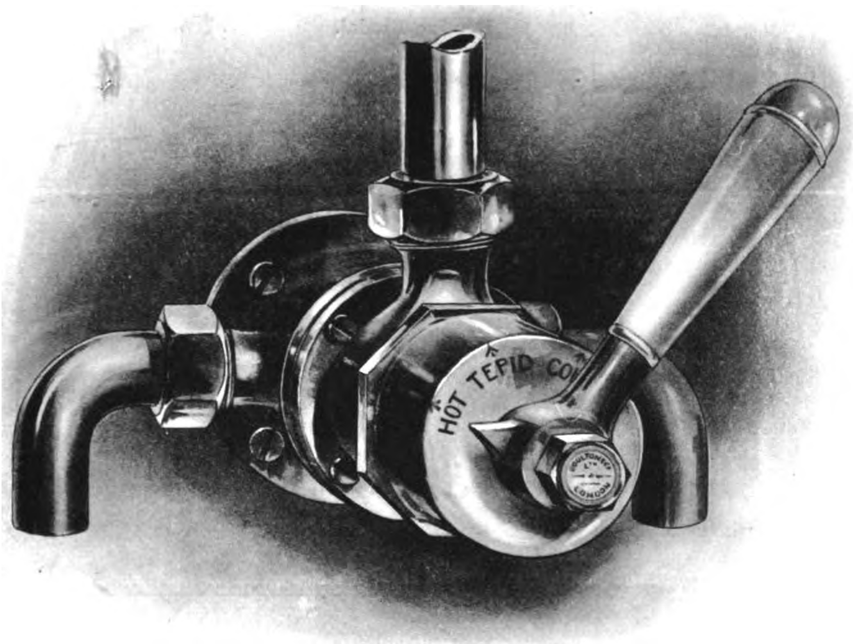
Bronze Medal.

To Pountney & Co., Ltd., Bristol Pottery, Bristol.

Non-concussive Water Mixing Valve.

Bronze Medal.

To Doulton & Co., Ltd.



This valve is made for the purpose of mixing hot with cold water for baths, etc. The cold water must be turned on first, thus preventing chance of scalding by accidentally opening the hot supply too soon; the water is mixed by one movement of the valve and can be had at any temperature required. The valve has two seatings, and there is a complete absence of concussion, even on high pressures, thus preventing the risk of straining or breaking pipes and joints. The valve is made in gun metal for use with steam instead of hot water, the outlets are screwed for iron pipe, or if preferred, they can be flanged.

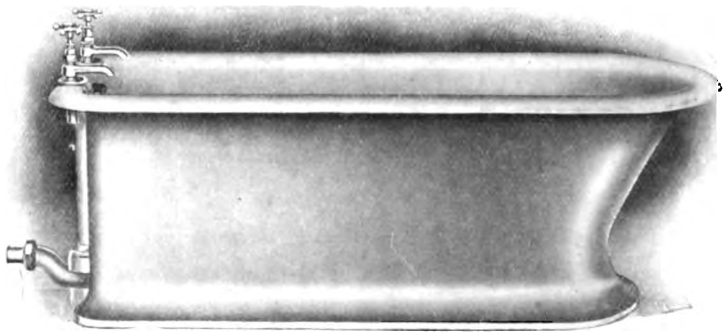
Prices.—1 in., £3 3s. $1\frac{1}{4}$ in., £3 12s. 6d.

Manufactured by Doulton & Co., Ltd., Lambeth, S.E.

Bath with Concave Plinth.

Bronze Medal.

To Shanks & Co., Ltd.



Manufactured by Shanks & Co., Ltd., Barrhead, N.B.

Hassall W.C. Suite, with 1½-gallon Flush.

Bronze Medal.

To C. W. Outram & Co.

This closet is designed to thoroughly wash the basin, remove the soil, and to leave clean water in the trap, with a single 1½-gallon flush.

Made for children and adults.

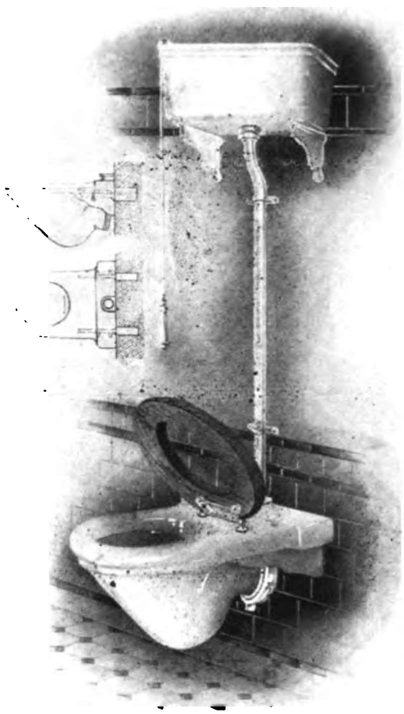
Price.—£3 11s.

Manufactured by C. W. Outram & Co., Woodville, near Burton-on-Trent.

Mural Bracket Closet.

Bronze Medal.

To Geo. Howson & Sons, Ltd.



Made in "Vitrolite" non-porous fireclay, white porcelain enamelled inside and out. Polished teak seat, with gun metal pillar hinges. It is arranged so that the basin can be removed without disturbing either wall or soil pipe.

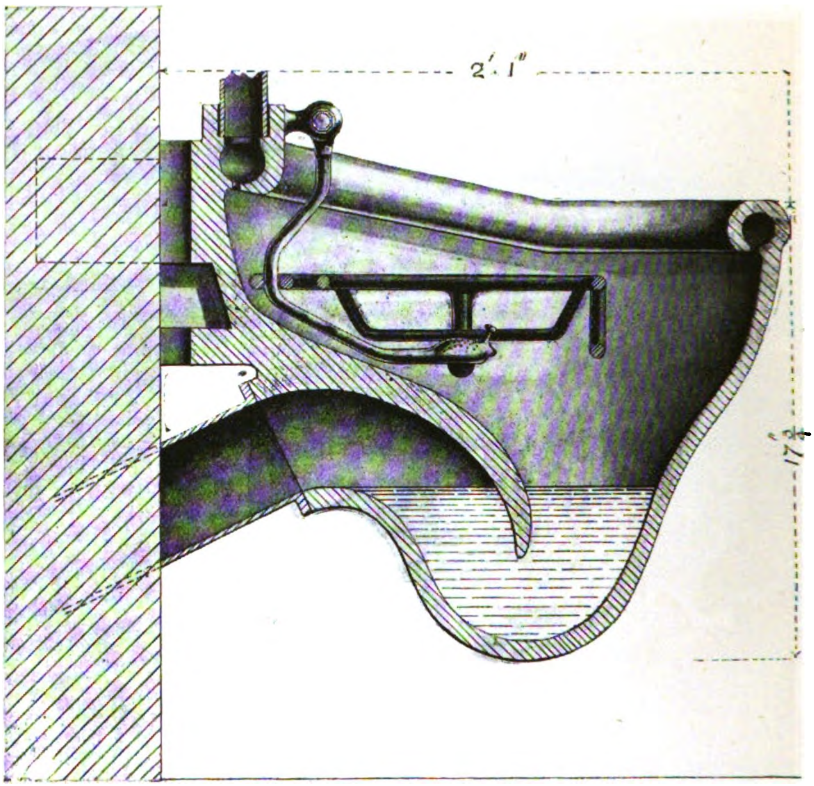
Price.—£7 10s.

Manufactured by Geo. Howson & Sons, Ltd., Hanley.

Adjustable Vulcanite Grill for Bedpan Suite.

Bronze Medal.

To Shanks & Co., Ltd.



The grill is basket shape, with a douching jet at the bottom for holding the bed pan, and is attached above the slop sink. It is suspended by an arm hinged above the slop sink so that it can be turned up free from the sink.

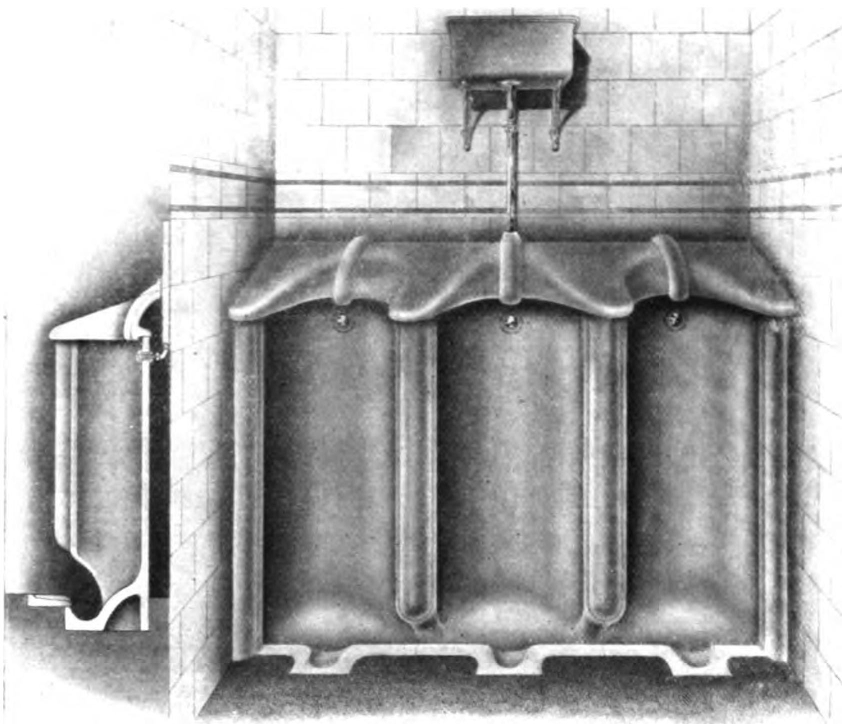
Price.—£15 15s.

Manufactured by Shanks & Co., Ltd., Barrhead, N.B.

School Urinal, with Vertical Water Check and Flush Riser to Channel.

Bronze Medal.

To Doulton & Co., Ltd.



Range of urinals, with backs and channel in one piece, jambs, tops, key pieces and treads in strong glazed fireclay, vitreous enamelled cast iron hinged grating for outlet of channel. In buff glazed ware.

Sizes.—Measurements, height, 3 ft. 9 in. From centre to centre, 1 ft. 8 in.

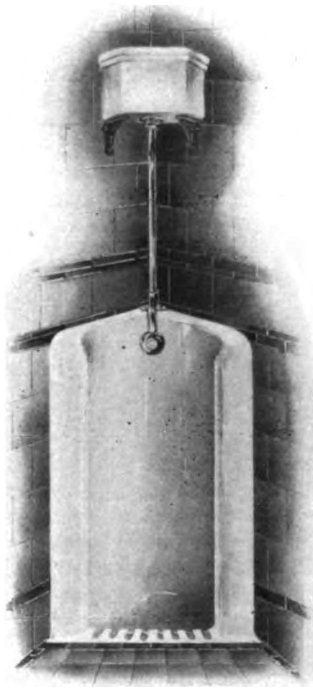
Price.—£19 1s. for range of three urinals.

Manufactured by Doulton & Co., Ltd., Lambeth, S.E.

Angle Urinal.

Bronze Medal.

To Geo. Howson & Sons, Ltd.



Made in Westwood porcelain enamelled fireclay, back, sole and channel in one piece.

Sizes.—Floor to top of hall, 3 ft. 2½ in., length of side, 18 in. Width of stall, 2 ft. 2 in., depth in floor, 5 in.

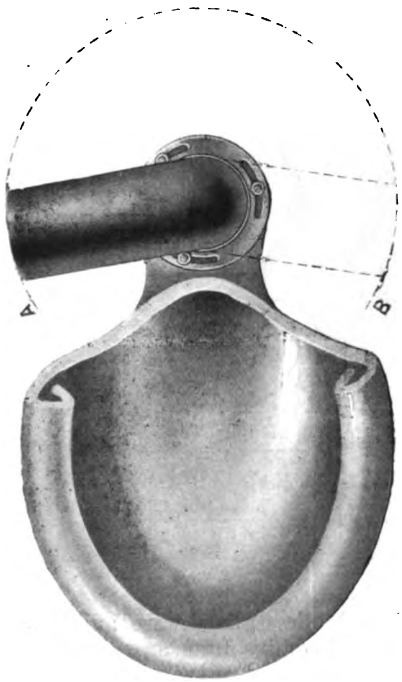
Prices.—All white enamelled, £5 15s. Buff, £4 19s.

Manufactured by Geo. Howson & Sons, Ltd., Hanley.

Radial-jointed Trap Outlet.

Bronze Medal.

To J. Duckett & Sons, Ltd.



The Lead Bend can be turned in any direction between A and B.

The joint consists of an application of a movable brass plate, packed with red lead or other suitable jointing material. It allows the outlet to be turned in any direction without any specially-made bend, and the joint being under the water seal insures it being airtight. It is readily attachable or detachable.

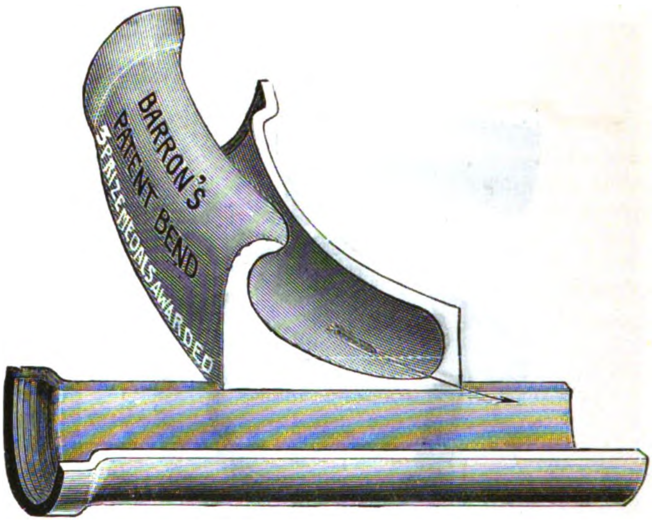
Made in sizes suitable for ordinary water-closets.

Manufactured by J. Duckett & Sons, Ltd. (Debney's Patent). Blannel Street, Burnley.

Channel Bends for Manholes.

Bronze Medal.

To Wm. Harriman & Co., Ltd.



Manufactured in white leadless glazed ware, and brown vitreous salt glazed ware. For connecting branch drains from any direction into manhole, shaped to direct sewerage into main channel, preventing fouling of benchings. Plugs can be inserted, to test all branch drains, and clearing rods applied in cases of stoppage.

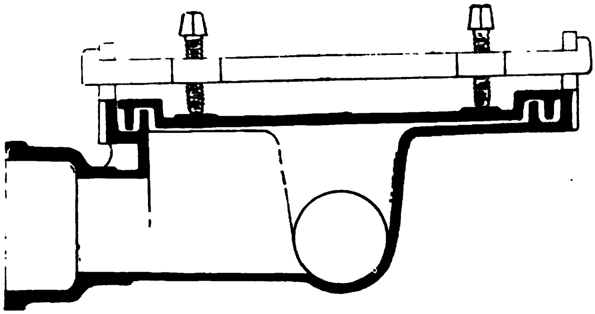
Sizes.—	4″ diam.	6″ diam.	9″ diam.
Prices.—White glazed	2s. 6d. each.	3s. 6d. each.	5s. each.
Brown glazed	1s. 9d. each.	2s. 6d. each.	3s. 6d. each.

Manufactured by Wm. Harriman & Co., Ltd., Newcastle-on-Tyne.

Iron Inspection Chamber, with Low-level Cover.

Bronze Medal.

To John Jones.



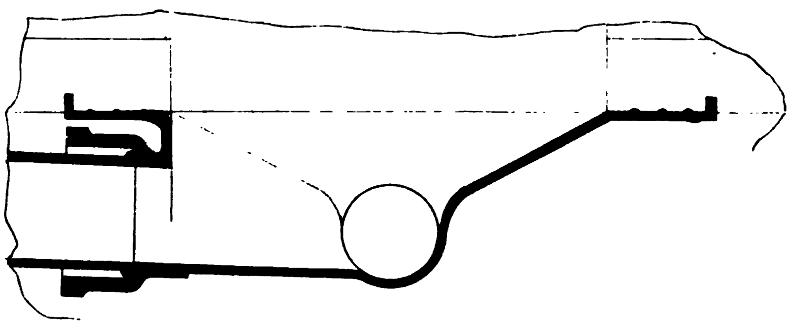
These are made in one casting, in lengths varying according to the number of branch inlets required. The branch inlets are connected to the main channel by bends formed inside the chamber with proper benchings. They are made with sealed cover, having strong wrought iron bridles and gun metal screws. The top cover is fitted so that all sewage matter passing through chamber or branches is confined to its own channel.

Manufactured by John Jones, Carlyle Works, Chelsea, S.W.

Iron Bottom for Intercepting Chamber.

Bronze Medal.

To John Jones.



These chambers are made in one casting, in lengths varying according to the number of branch inlets required. The branch inlets are connected to the main channel by bends formed inside the chamber with proper benchings. Glazed or other brickwork is formed on the specially constructed flanges and continued to ground level in usual manner.

Manufactured by John Jones, Carlyle Works, Chelsea, S.W.

Lead Pipes.

Bronze Medal.

To Rowe Bros. & Co., Ltd.

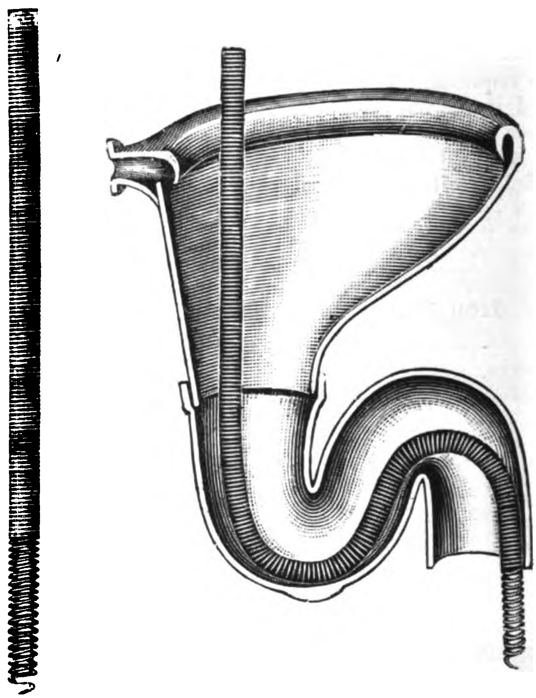
Lead pipes, ranging from $\frac{1}{8}''$ to $6''$ bore, also rectangular, shewing various substances, the heaviest being $1''$ bore by $1\frac{1}{2}''$ thick. Lead soil-pipes and ventilating pipes of every size and substance.

Manufactured by Rowe Bros. & Co., Ltd., Canons Marsh, Bristol.

Spiral Wire Drain and Pipe Cleaner.

Bronze Medal.

To The Spring Bending Co.



This consists of a spirally-coiled steel wire, which is flexible enough to be passed through the gully or trap into the drain to clear it. It has a handle fixed at one end to enable the rod to be turned about in the drain, and it can be attached to additional lengths of the same kind, or to an ordinary cane-rod cleaner.

6 ft., in two lengths, with handle and joint to attach to cane rods, 15s.

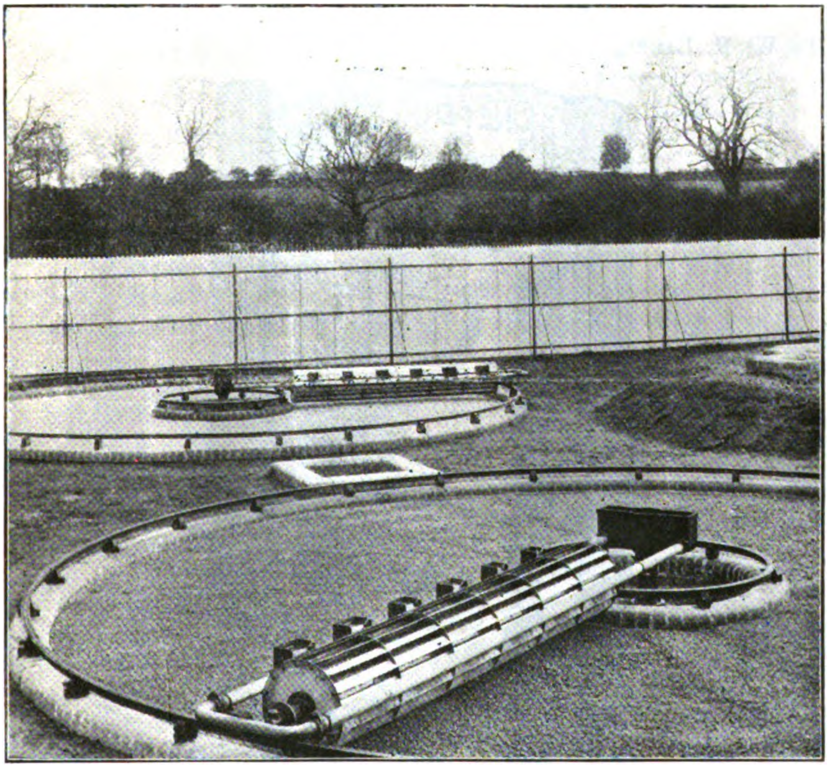
Extra 3 ft. lengths, 6s. each.

Manufactured by The Spring Bending Co., Handsworth, Birmingham.

Fiddian's Rotary Distributor.

Bronze Medal.

To BIRCH KILLON & Co., Cooper Street, Manchester.



Consists of an elongated water wheel, which in revolving on its horizontal axis, carries itself over the surface of a filter on roller tracks by means of wheels fixed on or connected to its axle. It is connected by a pipe to a supply of sewage or tank effluent, and the sewage falling into the buckets of the wheel a little above its axis spreads itself along the bucket (divided for convenience into sections) and its weight causing rotation of the wheel drum, it is immediately sprinkled falling from the buckets on to and across the whole surface of the filter without the use of small holes.

Various sizes.

Locking Bricks.

Bronze Medal.

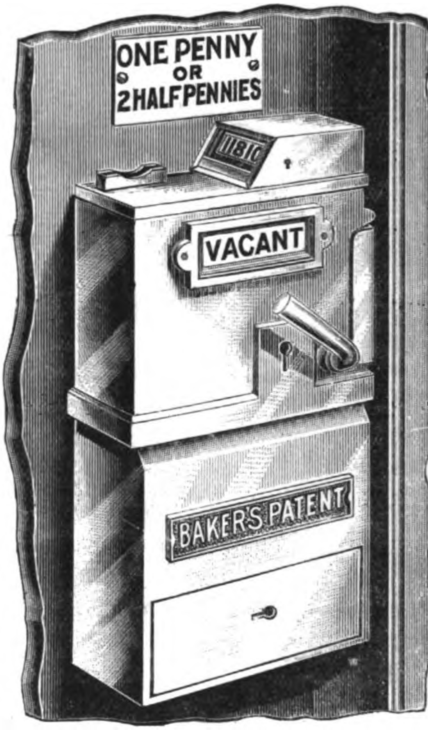
To Freeman Hines, Ltd., Victoria Street, S.W.

Made of blue Staffordshire ware with dowels and recesses which secure the bonding without cement or mortar. Size.—9 in. by $4\frac{1}{2}$ in. by 3 in.

Combined Coin-receiving and Registering Lock for Closets.

Bronze Medal.

To W. R. Baker.



This lock counts every penny it receives. The attendant's key acts like a coin and enables the door to be opened with the outside handle, but it requires the inside one to be turned as well to complete the movement of the register. The attendant can enter the closet as often as necessary, if he does not let the door close behind him. The lock is so arranged that the attendant cannot admit a person with his key and keep the penny, and as the lock is not blocked by bent coins he has no excuse to ever touch the money. The No. 1 lock shews "engaged" automatically, and this cannot be changed to "vacant" until the door is closed a second time.

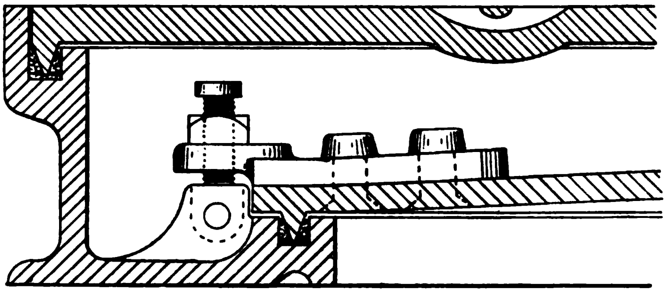
Prices.—No. 1, with register, £3 0 0; without, £2 5 0
2, „ £2 17 0; „ £2 2 0

Manufactured by W. R. Baker, 9, Belmont Road, Wallington, Surrey.

Metal Inspection Covers, with non-detachable Fastenings.

Bronze Medal.

To John Knight & Sons.



Sizes.—Inside 18″ × 12″ to 30″ × 24″
Outside 26″ × 20″ to 38″ × 32″

Prices.—From 24s. 9d. to 44s.

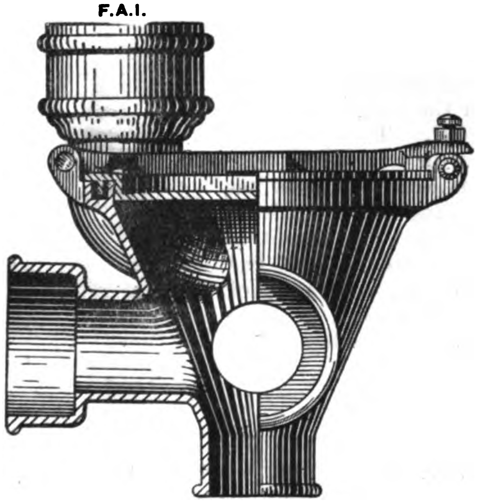
Manufactured by J. Knight & Sons, 24, Gertrude St., Chelsea, S.W.

Iron Glass-lined adjustable Gully Trap, with Sealed Top.

Bronze Medal.

To John Knight & Sons.

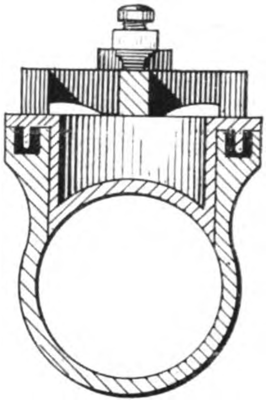
F.A.I.



An iron glass-lined gully with a hinged cover fitted into a flange, so that it can be made airtight.

Sizes.—4″ and upwards.

Manufactured by John Knight & Sons, 24, Gertrude St., Chelsea, S.W.



Iron Access Caps, concentric with interior of Pipes.

Bronze Medal.

To John Knight & Sons.

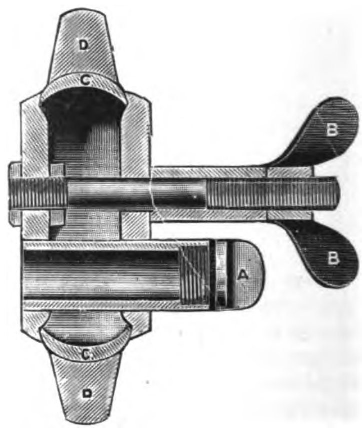
Sizes.—2″ and upwards.

Manufactured by John Knight & Sons, 24, Gertrude St., Chelsea, S.W.

Combined Expansion Drain-testing Plugs.

Bronze Medal.

To David Smith.



The plug itself has an expansion of from $3\frac{3}{4}''$ to $5\frac{1}{4}''$, and when the auxiliary ring is added it expands to $6\frac{3}{8}''$. The plugs are made in two kinds: (1) for water-tests only, (2) for smoke- or water-tests; the latter has a centre outlet. The wing nut is made to run in a ball-bearing race. The weight of plug and ring combined is about 4 lbs. The rings will fit and work on any other make of plug. C is the fixed rubber ring; D is the auxiliary ring. The plugs are made of brass plates.

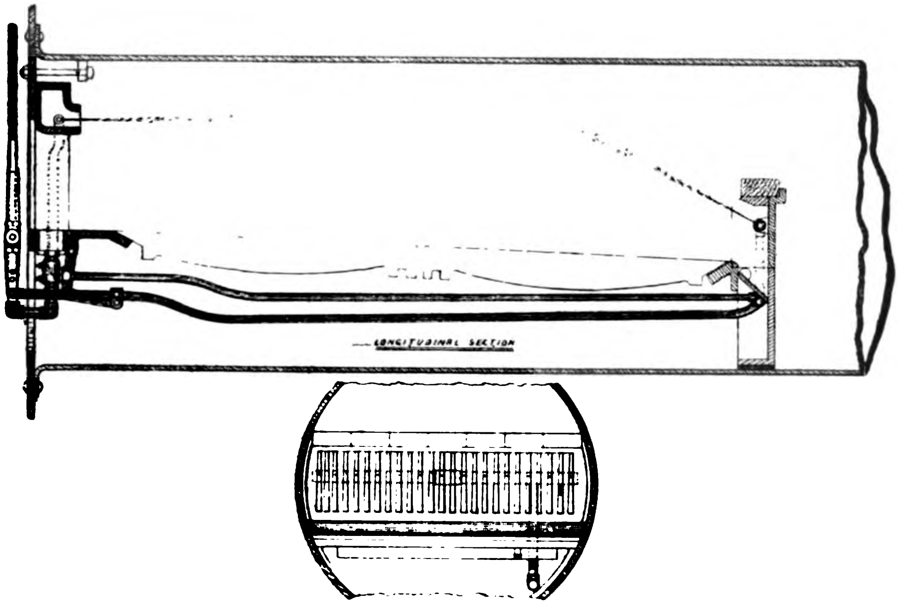
Prices.—Complete, 13s. 6d., 17s. 6d.; Ring only, 4s. 6d.

Manufactured by Smith & Co., 284, South Road, Walkley, Sheffield.

"Bunsen Bridge," for Boiler Furnaces.

Bronze Medal.

To The British Fuel Economiser and Smoke Preventer.



The principle on which the invention is based is the conversion of an ordinary furnace into one having the features of a Bunsen burner. This object is attained by admitting heated air (usually at the back or sides of the furnace) through a specially designed cast-iron air bridge or bridges, having vertical openings or slots, which distribute the air over the fire in such a manner and in such a quantity as to insure the gases being freely intermixed before they enter the nascent state. The slots are narrower at the top than at the bottom, and taper backwards and downwards to allow the ashes to pass to the ashpan. At the back of the air bridge is fixed a half-inch steam pipe, with a small perforation opposite every alternate slot in the bridge for the purpose of injecting a small amount of steam with such force as to draw in sufficient air to convert the furnace into a forced Bunsen. The inside chamber of the bridge is so constructed as to ensure the air being heated to a high temperature before entering the furnace, and the steam jets act as "steam pokers," splitting and stirring up the finely-divided products of part combustion, and getting them into a state ready for combination with the oxygen following the jets of steam. Thus, with the temperature in the furnace raised and the atmospheric air being heated, the result is a rapid and intimate mixture of the gases with the supporter of combustion.

Sizes to suit furnaces of all types and sizes.

Prices according to type of boiler and dimensions, from £40 to £75 nett.

Manufactured by The British Fuel Economiser and Smoke Prevente
Offices :—9, Bedford Row, W.C. Works :—54, Bermondsey Street, S.E.

Hopper Ventilator with Folding Sides.

Bronze Medal.

To Combination Collapsible Ventilator Co., 85, Duke St., Liverpool.

Cleansed Flock.

Bronze Medal.

To B. Maggs & Co.

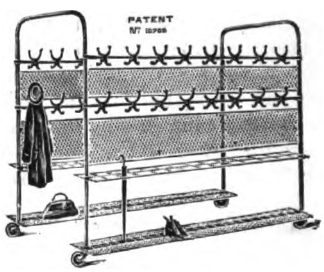
Wools and Flocks for Bedding. These are first washed with water and then subjected to 240 degrees of dry heat for six hours.

Manufactured by B. Maggs & Co., 3 & 4, Royal Promenade, Clifton, Bristol.

Steel Portable Cloak Room Fittings.

Bronze Medal.

To The "England" Works.



These fittings can be fixed to floors, or the smaller stands supplied with castors. Adjustable number or name tablets are supplied to each hook; 25 hooks for hats and cloaks, with racks for umbrellas, bags, etc., per square yard floor area. The hooks can be solid brass or entirely in polished brass, and the fittings may be combined with steam heating and drying apparatus.

Stock Sizes.—4 ft., 6 ft., 8 ft., and 12 ft. × 3 ft. or 4 ft. wide.

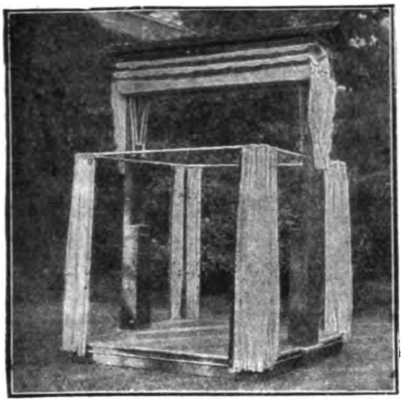
Prices.—From 3s. per accommodation.

Manufactured by The England Works, Benson Street, Leeds.

Canvas Outdoor Sleeping Chamber.

Bronze Medal.

To ALFRED WILLIAMS.



The roof being in several sections with ventilating spaces between the sections, and by means of winding gear the roof can be partly or wholly raised. The curtain walls can be readily closed and locked or *vice versâ*.

Various sizes and prices.

Manufactured by G. A. WILLIAMS & SON, 21, Queen's Road, Bayswater.

Compressed Sanitary Towels and Surgical Dressings.

Silver Medal.

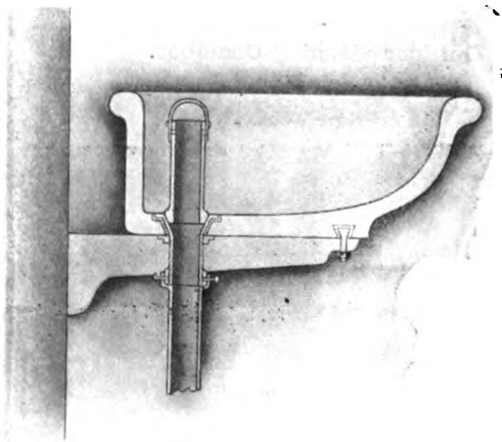
To ROBINSON & SONS, LTD.

Manufactured by ROBINSON & SONS, LTD., Chesterfield.

Oval Operating Lavatory, with Knee-operated Mixing Valve.

Bronze Med

To Doulton & Co.



Made of white glazed fireclay, with recessed basin and vulcanite standing waste, hot and cold combined valve to be actuated by the knee. Top supported on vitreous enamelled cast-iron cantilevers and white vitreous enamelled iron waste pipe.

Size.—28″×21″, with recessed basin 24″×16″

Price.—About £10.

Manufactured by Doulton & Co., Ltd., Lambeth.

Aseptic Glass Serum Syringe.

Bronze Medal.

To Ferris & Co., Ltd.

Manufactured by Ferris & Co., Ltd., Bristol.

Malted Cocoa.

Bronze Medal.

To J. S. Fry & Sons, Ltd.

A combination of Fry's pure cocoa with Allen & Hanbury's concentrated extract of malt. It is dried at a gentle heat to avoid injury to the diastase.

Prices.—In tins, 6d., 1s., 2s.

Manufactured by J. S. Fry & Sons, Ltd., Bristol.

Milk Chocolate.

Bronze Medal.

J. S. Fry & Sons, Ltd.

A combination of pure cocoa with sweetened milk.

Manufactured by J. S. Fry & Sons, Ltd., Bristol.